FIFTH EDITION

THE NAVIGATOR OR MARINERS' GUIDE

A BOOK CONTAINING VALUABLE ORIGINAL INFORMATION CAREFULLY COMPILED

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MARINERS' GUIDE

A HANDY REFERENCE WORK FOR THE USE OF NAVIGATORS, YACHTSMEN AND STUDENTS OF NAVIGATION

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EXPLAINING
HOW TO FIND
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AND
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MANY OTHER USEFUL
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BY

CAPT. R. M. PUGSLEY

(LATE MASTER U. S. TRANSPORT SERVICE)

AUTHOR OF "THE PILOT," "HOW TO DO THE WORK," ETC.

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IMPORTANT NOTICE.

In presenting this fifth edition to our thousands of friends using NEW JERSEY MARINE PAINTS, it is to be understood that its contents are not a compilation of worthless matter extracted from the many useless nautical publications put on the market during the last few years by persons having no sea experience and no practical knowledge on which to construct a work of true worth to the navigator, yachtsman and all others interested in marine matters.

In the manufacture of NEW JERSEY COPPER PAINT and MARINE PAINT SPECIALTIES, our great aim has been to produce PAINTS of a SUPERIOR QUALITY for the various purposes for which they may be used. Regarding the superior quality of these PAINTS, there can be no stronger support to the statement, than in the fact that the demand for NEW JERSEY COPPER PAINT and MARINE PAINT SPECIALTIES is constantly increasing, and also the facilities for their manufacture, that this demand may be met.

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Any person who uses this book and NEW JERSEY COPPER PAINT and MARINE PAINT SPECIALTIES together with their respective instructions and directions, will be able to navigate his vessel with safety and despatch.

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Preface to Fifth Edition.

The demand for "The Navigator" continues from all parts of the world and well indicates the dependence placed upon it by Mariners both of the old school and the new. We feel compelled as a matter of duty to continue the publication for the benefit of those who require a concise and intelligible aid to navigation at small expense.

PREFACE TO FOURTH EDITION.

The third edition of "The Navigator" being exhausted by the demands of those entering the Naval Service of the United States, the fourth edition is printed especially for those in the United States Naval Service with a view to helping them in their work.

No expense has been spared to keep it up-to-date, and efficient, yet easily understood.

Our aim has always been to make and keep it the best and most useful one volume on Navigation.

The first, second and third editions, 45,000 copies, have been distributed all over the world.

PREFACE TO THIRD EDITION.

(15,000 Copies)

CONSIDERABLE new matter, not contained in any other work, have been added that the present conditions may be met. The demand for the previous editions indicated that an enlarged work would be a benefit and supply a want not fully satisfied by any other treatise. Beyond a general increase in the scope of the work no change is made in the general treatment of the subject—PRACTICAL NAVIGATION for those who wish to use it for the purposes intended.

R. M. PUGSLEY.

PREFACE TO SECOND EDITION.

15,000 Copies.

THE previous edition (15,000 copies) of this work having been exhausted and the demand having constantly increased, this edition is revised and enlarged by adding much valuable matter not generally found in a work of this kind, and which does not exist in a manner conveniently accessible to those for whom this volume is intended, and in so doing the requirements of the practical experienced navigator and the yachtsman and student have been considered with equal care, at the same time preserving the general arrangement of the original work.

While this volume is a handy and comprehensive reference work, it is in consequence of the many changes and character of new matter also an epitome of navigation, with the exception of the tables which are not included, as those of Bowditch cannot easily be improved on and are to be preferred to any other.

R. M. PUGSLEY.

PREFACE TO FIRST EDITION.

15,000 Copies.

THIS work is intended to meet the ever-increasing demand for a handy and comprehensive volume for the general use of navigators, yachtsmen and others, who frequently find it necessary to look up something quickly regarding navigation or other nautical information.

Care has been exercised in constructing work to introduce only such matter as is known to be of real value to those interested in nautical subjects, and attention is called to the many tables and general information, in addition to navigation, that are almost indispensable to any shipmaster or officer.

In most works on navigation, the subject is buried in technicalities and complications to so great a debt that the student cannot acquire it without taking up the study of the subject to the exclusion of all other matter. In this work, navigation is brought to the surface, and within easy reach of the student. Any person of average intelligence can acquire a fair knowledge of navigation by a little study of the subject as treated in these pages.

The various problems in navigation are made as plain as possible that the requirements of the student, as well as the navigator, may be met. However, only the most reliable and correct methods of determing latitude and longitude by observation and dead reckoning are given.

Bowditch tables are used in all calculations throughout the work, and where table numbers are not mentioned, those of Bowditch and no other are referred to.

The rules for using the barometer for foretelling the whether and for handling vessels in hurricanes are not written from theory alone, but from actual experience in large and small vessels covering a period of several years.

R. M. PUGSLEY.

"NEW JERSEY"

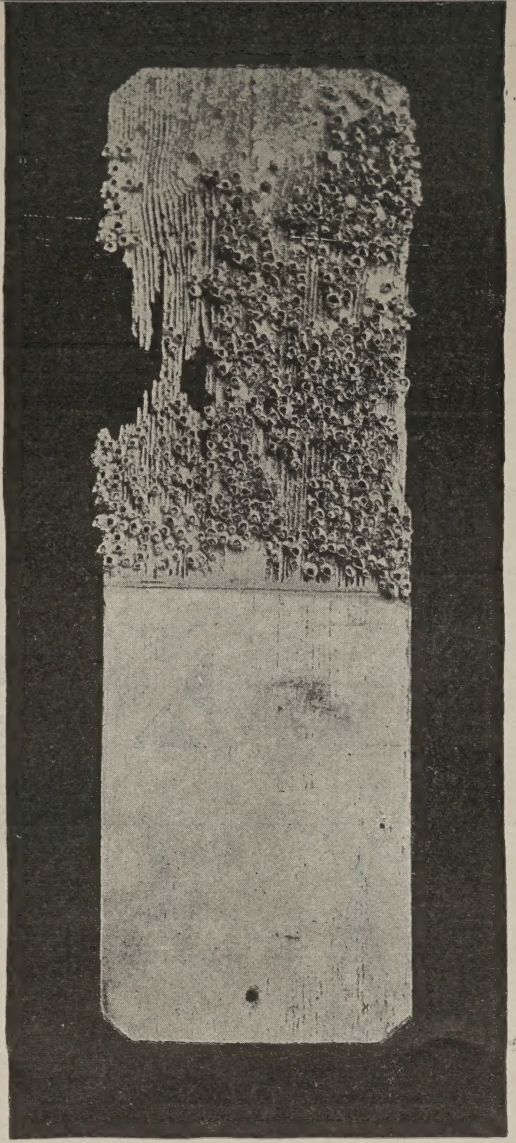
REMARKABLE FACT.

THIS cut is a copy of a photograph of a board having one end painted with **"NEW JERSEY" COPPER PAINT,** manufactured by Harry Louderbough, proprietor of NEW JERSEY PAINT WORKS, Jersey City, N. J., U. S. A., and placed in the water at Port Royal, S. C., for five months. Upon the unpainted end you can note the ravages of the salt water worm so destructive to wood, and also the large number of barnacles that have fastened upon it. Observe the painted end, where **"New Jersey" Copper Paint** was applied—its splendid condition.

The board here represented was placed in the water at Port Royal, S. C., by me, and left in the water five months. The painted end was as good as when it was placed in the water.

MILLS EDWARD,
Master Schooner "Florence Shay."

ONLY ONE BRAND AND THAT THE BEST.



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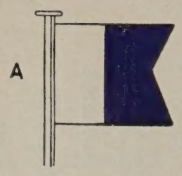
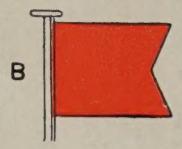
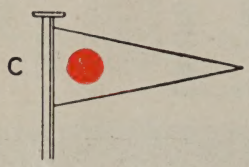
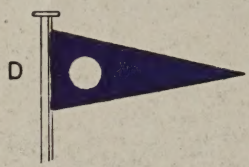
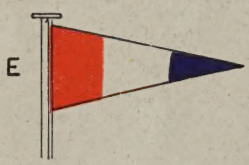
FLAGS AND PENNANTS OF THE INTERNATIONAL CODE.

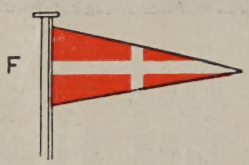


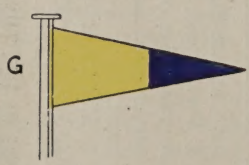


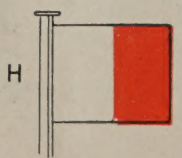


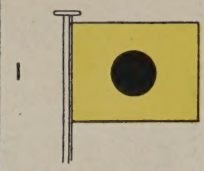


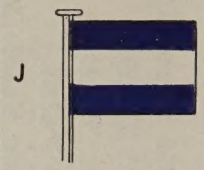


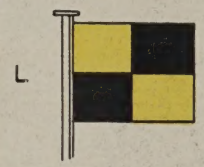


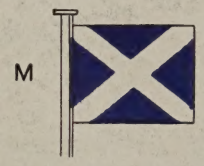


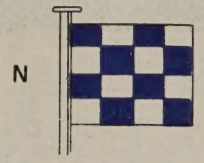


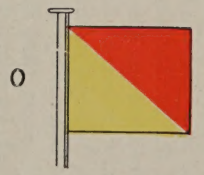


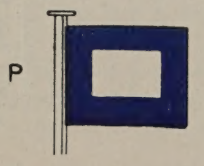


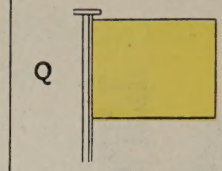


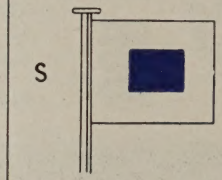


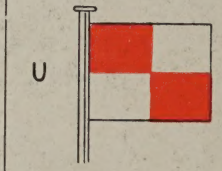


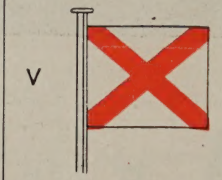


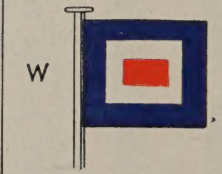


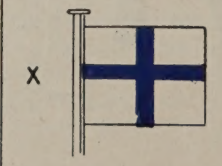












"CODE FLAG" and "ANSWERING PENNANT."

When used as the Code Flag It is to be hoisted under the Ensign
When used as the Answering Pennant it is to be hoisted at the mast head or where best seen

Flag meanings when hoisted single

A—"I am on Full-Speed Trial"
B—"I am taking in (or discharging) Gunpowder, or other Explosives"
C—"Yes" or Affirmative
D—"No" or Negative
E—Alphabetical Signal No. 1
F—Alphabetical Signal No. 2
G—Alphabetical Signal No. 3
H—"Stop or Heave to," or "Come Nearer," "I Have Something Important to Communicate."
I—"I Have Not a Clean Bill of Health"
J—"I Have Headway"
K—"I Have Sternboard"
L—"I Have (or Have Had) Some Dangerous, Infectious Disease on Board"
M—Numeral Signal No. 1
N—Numeral Signal No. 2
O—Numeral Signal No. 3
P—Blue Peter—"I am About to Sail; All Persons report on board"
Q—Quarantine—"I Have a Clean Bill of Health, but Am Liable to Quarantine"
R—"Do not Pass Ahead of Me"
S—"I Want a Pilot"
T—"Do Not Overtake Me"
U—"My Engines are Stopped"
V—"My Engines are Going Astern"
W—"All Boats Are to Return to the Ship"
X—"I Will Pass Ahead of You"
Y—"All Ships of the Convoy Are to Rejoin Company"
Z—"I Will Pass Astern of You"

NOTE.—It is desirable, to prevent confusion, that the pennants used should be at least twice as long as the burgees and square flags.

THE INTERNATIONAL CODE

The International Code of Signals consists of twenty-six flags, one for each letter of the alphabet, and a code pennant.

The most important and urgent signals are in hoists of one or two flags; other signals are in hoists of three or four flags.

The Code has been printed in every language, and as all use the same flags it is possible for ships of two different nations to communicate without knowledge of one another's language.

INSTRUCTIONS HOW TO SIGNAL.

Ship A wishing to make a signal hoists her Ensign with the Code Flag under it.

Ship B seeing that A wants to signal hoists her Answering Pennant at the "dip" (about two-thirds of the way up).

Ship A seeing the answer proceeds with the signal she desires to make first hauling down her Code Flag.

Each hoist should be kept flying until B hoists her Answering Pennant.

Ship B, when she understands the hoists her Answering Pennant "close up" and keeps it there until A hauls her hoist down.

B then lowers her Answering Pennant to the "dip" and waits for the next hoist.

When A has finished signaling she hauls down her Ensign.

A FEW OF THE URGENT SIGNALS.

AB——Abandon the vessel as fast as possible.
AC——Do not abandon the vessel.
AG——I must abandon the vessel.
AM——Accident; want a surgeon (or doctor).
AQ——Boat is lost.
BI——Damaged rudder; can not steer.
BJ——Engines broken down; I am disabled.
BN——I am very seriously damaged.
BT——Want a boat; man overboard.
BZ——Am aground.
CL——Am disabled; communicate with me.
CM——Am drifting; want assistance.
CR——Do not require assistance (or further assistance).
CX——No assistance can be rendered; do the best you can for yourselves.
DV——Show your distinguishing signal.
DW——Show your ensign.
EQ——Bar is impassible for boats on the ebb tide.
ET——Boat is coming to your assistance.
EW——Can boat land? Can landing be effected?
EY——Do not attempt to land in your own boats.
FH——Send a boat *(number if necessary)*.
FJ——Send a lifeboat to save crew.
FN——Appearances are threatening; be on guard.
FP——Bad weather is expected.
FQ——Bar, or entrance is dangerous.
FU——Channel, or Fairway is dangerous.
FW——Do not attempt to make the harbor (or anchorage).
GK——Wait until the weather moderates.
GN——You are in a dangerous (or unsafe) position. Your position is dangerous.
GY——Can you spare me coal?
HM——Vessel seriously damaged; wish to transfer passengers.
HP——I am loaded with combustibles.
HU——Can you forward my communication by telegraph?
ID——Heave-to, or I will fire into you.

JD——You are standing into danger.
JE——Beware of derelict; dangerous to navigation.
JP——Have letters (mails or despatches) for you *(or vessel, or person indicated).*
JT——Have you letters (mails or despatches) for me *(or for vessel, person or place indicated).*
JB——I am the bearer of important despatches.
JZ——Boat should endeavor to land where flag is waved (or light is shown).
KA——Endeavor to send a line by boat (cask, kite, raft, etc.).
KC——Keep a light burning.
KD——Landing is impossible.
KE——Lights or Fires will be kept at the best place for coming on shore.
KF——Look out for rocket-line (or line).
KG——Look-out will be kept on the beach all night.
KH——Remain by the ship.
KR——Let go another anchor.
KS——Ride it out if possible.
KT——Shift your berth; your berth is not safe.
KX——You will be aground at low water.
KZ——Anchor instantly.
LC——Buoy, or Mark is not in its proper position.
LE——Do not anchor on any account.
LF——Get her on the other tack (or, Get her head around), or you will be on shore.
LS——It is not safe to go so fast.
LU——Keep in the centre of the channel.
LV——Keep on the port side of the channel.
LW——Keep on the starboard side of the channel.
LZ——Leave the buoy (or beacon) to port.
MA——Leave the buoy (or beacon) to starboard.
NA——Aground; want immediate assistance.
NB——Can not save the ship; take people off.
NC——In distress; want immediate assistance.
NG——Fire gains rapidly; take people off.
NH——Fire or leak; want immediate assistance.
NJ——I am attacked; want assistance. Help, I am attacked.
NL——I am in danger; (or shoal water) direct me how to steer.
NH——I am on fire.
NO——I am sinking (or on fire), send all available boats to save passengers and crew.
NQ——I have sprung a leak.
NR——I want assistance; please remain by me.
NS——In distress want assistance.
NV——Short of provisions; starving.
NY——With immediate assistance fire can be extinguished.
OE——Enemy is in sight.
OG——Enemy's fleet has been seen to the ———, steering to the ———.
OI——Have been chased by the enemy.
OJ——Keep a good look out, as it is reported that enemy's war vessels are going about disguised as merchantmen.
OL——Vessel in sight is an enemy.
OW——Channel or Fairway, is buoyed.
PC——Is the channel buoyed?
PT——Want a Pilot.
PW——Can you give me leading marks (or direction) for making the land hereabouts *(or at place indicated)?*
QD——Light is not to be depended on.
QE——The lightship at ——— is not at anchor on her station, or lightship at ——— is out of position.
QH——Can not stop the leak.
QN——Has the mail arrived——(from ———, *—if necessary)?*
QO—— Has the mail sailed ——(for ———, *—if necessary)?*
QP——I will take mails for you.
QT——When does the mail leave?

QU—Will you forward my letters to ——— ?
QV—Do not show a light on any account.
QW—I will show a light tonight when I alter course.
QX—I will show a light tonight when I tack.
QY—Keep a light at your bowsprit end.
RF—Boiler leaking seriously.
RM—Did you get good observations?
RN—Have you a book of Navigation Tables?
RO—Have you a book of Sailing Directions?
RP—Have you a chart of Coast *(or place indicated)*?
RQ—Have you Nautical Almanac for the current year *(or year indicated)*?
RV—What is my position by bearings?
RW—What is the name of lighthouse (lightship or point) in sight?
RZ—Where am I? What is my present position?
SM—Have orders (or telegram) for you.
SX—Keep off and on and await instructions.
TI—Dangerous without a pilot.
TL—Where can I get (or look for) a pilot?
TX—Wait for answer (or reply).
UA—Will you await answer (or reply)?
VE—Annul the last hoist; I will repeat it.
VF—Annul the whole signal.
VG—What is the name of ship (or signal station) in sight?
VI—Repeat your signal, or repeat your signal from ——— *(hoist indicated)*.
VJ—I wish to signal; will you come within easy signal distance?
VM—Can not distinguish your flags; come nearer, or make distinct signals.
VP—I am in ——— feet of water.
VQ—What is the depth of water on the bar?
WM—No surgeon available.
WN—Surgeon will come immediately.
WO—Want a surgeon; send me one from the nearest place.
WP—Will your surgeon come on board?
WV—In anchoring look out for telegraph cable.
XC—Shall I open your telegram and signal its contents?
XF—How is the tide? What tide have we now?
XG—Keep out of the tide or current.
XH—What is the rise and fall of the tide?
XI—When will the tide ebb?
XJ—When will the tide flow?
XK—When will the tide turn?
XO—Beware of torpedo boats.
XP—Beware of torpedoes; channel (or fairway), is mined.
XQ—Channel, or Fairway is not mined.
XS—Is there danger of mines (or torpedo boats)
XU—Can you take me in tow?
XV—Can not take you in tow.
XY—Shall I take you in tow?
XZ—There are no tugs available.
YB—Want a cable (Size to follow).
YC—Want an anchor.
YD—Want an anchor and cable.
YE—Want assistance.
YH—Want chart of channel (or harbor, etc.)
YL—Want immediate medical assistance.
YR—Want water immediately.
ZE—I do not like the look of the weather.
ZO—I shall weigh as soon as weather permits (or moderates).
ZP—I shall weigh immediately *(or at any time indicated)*.

The International Morse or General Service Code.

The International Morse Code is the General Service Code and is prescribed for use by the Army of the United States and between the Army and the Navy of the United States. It will be used on radio systems, submarine cables using siphon recorders, and with the heliograph, flash-lantern, and all visual signaling apparatus using the wig-wag.

Alphabet.

A .—	G ——.	N —.	U ..—
B —...	H	O ———	V ...—
C —.—.	I ..	P .——.	W .——
D —..	J .———	Q ——.—	X —..—
E .	K —.—	R .—.	Y —.——
F ..—.	L .—..	S ...	Z ——..
	M ——	T —	

Numerals.

1 .————	3 ...——	6 —....	9 ————.
2 ..———	4 ....—	7 —...	0 —————
	5	8 ———..	

Punctuation.

Period	.. .. ..
Comma	.—.—.—
Interrogation	..——..
Hyphen or dash	—....—
Parentheses (before and after the words)	—.——.—
Quotation mark (beginning and ending)	.—..—.
Exclamation	——.——
Apostrophe	.————
Semicolon	—.—.—.
Colon	———...
Bar indicating fraction	—..—.
Underline (before and after the word or words it is wished to underline)	..——.—
Double dash (between preamble and address, between address and body of message, between body of message and signature, and immediately before a fraction)	—...—
Cross	.—.—.

CONVENTIONAL SIGNALS FOR USE BY RADIO STATIONS WITH THE INTERNATIONAL MORSE CODE.

The following conventional signals will be used by radio stations of the United States Army with the International Morse Code:

Distress signal (ship stations only)[1]	———...
Attention (or call)	The call is composed of the attention signal —.—.— followed by the call letters of the station called, repeated three times (if unknown) use CQ (—.—. ——.—) in place of call letters of station called), followed by DE (—.. .) and then the call letters of the calling station, repeated three times.
Have you anything for me	QRU (——.— .—. .—)
How many words have you to send	QRJ (——.— .—. .———)
Invitation to transmit (go ahead)	—.—
Signal separating preamble from address, address from text, and text from signature	—.——

End of message	.—.—.
End of work	...—.—, followed by the call letter of sending station and —.—
Received (acknowledgment of receipt of message)	R (.—.), followed by the call letter of the receiving station and personal signal of the receiving operator.
Here is another message	—.—.— (attention call).
Understand (or I understand)	...—., followed by the call letters of station.
Not understood (or repeat)	..——.. (Interrogatory) and the last word received.
Error	.....
Wait	.— ...
Official message	OFM (——— .—. ——)
(First word of preamble on all radiograms)	RADIO (.—. .— —.. .. ———)
Faster	QRQ (——.— .—. ——.—)
Slower	QRS (——.— .—. ...)
Stop sending	QRT (——.— .—. —)
Interference	XX (—..— —..—)
Use International Code of Signals	PRB (.——. .—. —...)
General inquiry call (when call of station is not known)	CQ (—.—. ——.—) (see attention call).
How do you receive me	QRK (——.— .—. —.—)

TRANSMISSION OF MESSAGES BY INTERNATIONAL MORSE.

EXAMPLE.

WVB sending to WVA a plain commercial message filed at 4 p. m., of the 12th, after receiving —.—

—.—.—	
RADIO	
Circle City	Office of destination.
De.	
Fairbanks	Office of origin.
2	Number of message.
L	Operator's sign.
8	Check.
Twelfth 4 pm	Date and hour of filing.
—...—	Break or double dash.
Brown 175 King Street	
Circle City	Address
—...—	Break.
Arrive tomorrow	Text.
—...—	Break.
Jones	Signature.
.—.—.	
KMO	
—.—	

TESTIMONIALS.

Cambridge, Mass.

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:—The 21 copies of "The Navigator" duly received for which please accept my thanks.

We have taken the liberty of disregarding your suggestion as to the disposal of these books, and have decided that they shall be kept in and for the school, for the use of instructors and students. You will readily see the advantages to all concerned, when I say that our course here is limited to six weeks, and students are continually entering and graduating from this school.

Hoping this may meet with your approval, I am

Yours truly,
FORSTER W. DUMARESQ.

Borden's Condensed Milk Co.,
Brooklyn, N. Y.

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:—I have been using your Green Copper Paint for the past 3 years and have not found its equal. I had my Boat in the water from June until December and when I pulled her out the entire hull was free of barnacles.

W. H. MILLER, Supt.

The Poughkeepsie Yacht Club.
Poughkeepsie, N. Y.

New Jersey Paint Works,
Harry Louderbough, Inc., Jersey City, N. J.

Gentlemen:—The Poughkeepsie Yacht Club's Navigation Class wishes to thank your Company for the fifty copies of the Mariner's Guide which you sent us gratis.

The class for a long time have known your paints but never before did we realize your broad business policy in recognizing the boating public, and yours is the only Company ever extended a helping hand to the Motor Boat Novice, without pay.

Yours very truly,
SIGNED by 45 MEMBERS.

Yct. "Nydia," Ft. 23rd Street,
Brooklyn, N. Y.

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:—I have been using your New Jersey Copper Paint and it has proven satisfactory to me. I have tried many other paints, but all without satisfaction. For the future I shall try your paint exclusively.

Yours respectfully,
Capt. W. A. WHITTIER.

VISUAL SIGNALING IN GENERAL.

Methods of visual signaling are divided as follows:

(a) By flag, torch, hand lantern, or beam of searchlight (without shutter). General Service Code.

(b) By heliograph, flash lantern, or searchlight (with shutter). (General Service Code.)

(c) By Ardois. (General Service Code.)

(d) By hand flags or by stationary semaphore. (Two-arm semaphore Code.)

(e) By preconcerted signals with Coston lights, rockets, bombs, Very pistols, small arms, guns, etc.

(f) By flags signals by permanent hoists. (International Code.)

The following conventional signals with exceptions noted, will be used in the first four classes.

		Exceptions.
End of word.	Interval.	Ardois and semaphore.
End of sentence.	Double interval.	
End of message.	Triple interval.	
Signal separating preamble from address; address from text; text from signature.	..—.—	Double interval, signature preceded also by "Sig." Interval.
Acknowledgement.	R.	A.
Error.	.....	
Negative.	K.	
Preparatory.	L.	
Annuling.	N.	
Affirmative.	P.	
Interrogatory.	..——..	O.
Repeat after word.	Interrogatory, A (word).	
Repeat last message.	Interrogatory three times.	
Send faster.	QRQ	
Send lower.	QRS	
Cease sending.	QRT	
Wait a moment.	.—...	None.
Execute.	IX, IX	
Move to your right.	MR	
Move to your left.	ML	
Move up.	MU	
Move down.	MD	
Finished (end of work.)	...—.—	None.

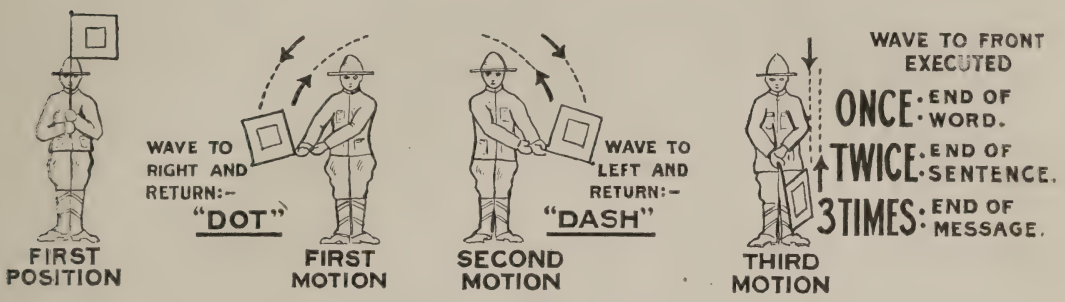
NOTE.—In order to differentiate these signals from important battle signals, the Navy uses certain distinguishing variations which are not necessary in signaling in the Army. In making the conventional signals for "A," Error, and "O," Interrogatory, in Ardois, the Navy indicates them by pulsating the upper light, in making them is semaphore, by agitating the arms or flags. "K," Negative; "L," Preparatory; "N," Annuling; "O," Interrogatory; and "P," Affirmative, in the Navy are secondary meanings, and are used in communication between the Army and Navy.

In communicating with the Navy, by all methods, numerals will be spelled out.

"Intervals" are expressed as follows in the various systems:

	Interval	Double interval	Triple interval
Radio. Flashing. Occulting light. Sound.	—space.	.. .. ..	.—.—.
Wigwag.	Front.	(Twice.)	(3 times.)
Semaphore.	Flags crossed or machine closed.	2 chops.	3 chops, withdraw flags or close machine and indicator arm.
Ardois.	.—.—	(Twice.)	(3 times.)

VISUAL SIGNALING: BY FLAG, TORCH, HAND LANTERN, OR BEAM OF SEARCHLIGHT (WITHOUT SHUTTER).



GENERAL SERVICE CODE.

For the flag used with the General Service Code there are three motions and one position. The position is with the flag held vertically, the signalman facing directly toward the station with which it is desired to communicate. The first motion (the dot) is to the right of the sender, and will embrace an arc of 90°, starting with the vertical and returning to it, and will be made in a plane at right angles to the line connecting the two stations. The second motion (the dash) is a similar motion to the left of the sender. The third motion (front) is downward directly in front of the sender and instantly returned upward to the first position. Front is used to indicate an interval.

The beam of the searchlight, though ordinarily used with the shutter like the heliograph, may be used for long distance signaling, when no shutter is suitable or available, in a similar manner to the flag or torch, the first position being a vertical one. A movement of the beam 90° to the right of the sender indicates a dot, a similar movement to the left indicates a dash; the beam is lowered vertically for front.

To use the torch or hand lantern, a footlight must be employed as a point of reference to the motion. The lantern is most conveniently swung out upward to the right of the footlight for a dot, to the left for a dash and raised vertically for front.

SIGNAL WITH HELIOGRAPH, FLASH LANTERN, OR SEARCHLIGHT

GENERAL SERVICE CODE.

The first position is to turn a steady flash on the receiving station. The signals are made by short and long flashes. Use a short flash for dot and a long steady flash for dash. The elements of a letter should be slightly longer than in sound signals.

To call a station make its call letter until acknowledged.

If the call letter of a station be unknown, signal A until acknowledged. Each station will then turn on a steady flash and adjust. When the adjustment is satisfactory the receiver will cut off his flash and the sender will resume his message.

To break the sending station for other purposes turn on a steady flash.

It may be noted that in the daytime and in ordinary weather the searchlight with shutter can be readily used for distances up to 10 miles at sea. This method of day signaling is considered of exceptional value by the Navy and is commonly used by the Coast Artillery in target practice from the shore to the tug towing the target. It is independent of background and may be used behind armor or other shelter; it should be frequently used for signaling by day as well as by night.

THE ARDOIS SYSTEM.

GENERAL SERVICE CODE.

The Ardois system, used in the United States Army and Navy, is a display of four lights, each of which may be made either red or white. These lights are incandescent lamps, operated by a keyboard conveniently placed at the station. The red light indicates a dot and the white light a dash, so that the characters of the General Service Code are made by combinations of red and white lights.

If the lights are arranged vertically, as when swung from a staff or spar, they are read from the top downward. If the lights are placed horizontally, they are read from the sender's right to his left.

Example: Red-white, or dot-dash, represents the letter A; and white-red-red-red, or dash-dot-dot-dot, represents the letter B.

For numerals in the Ardois system, secondary meanings (as numerals) have been assigned to the last 10 letters, Q being 1, R being 2, and so on, Z being 0. These secondary meanings are not used in communicating with the Navy; when communicating with the Navy the numerals of the International Morse Code must be spelled out in full.

When the letters of the alphabet are to be used to indicate the meaning set opposite them in the following tabulation, the upper light of the display is pulsated. This is effected by means of a special pulsating key.

RULES FOR USING THE ARDOIS SYSTEM OF SIGNALING.

In signaling by the Ardois system the Cornet, WWWW, is a general call to attention. A station desiring to exchange signals will display the call letters of the station wanted, which will be answered by a similar display from the station called, or from each station successively called.

If the call letters of a station be unknown, display the Cornet.

The calls having been answered, proceed with the message, or if a special or preconcerted code is to be used, so indicate, and when answered proceed with the message.

If it becomes necessary to put a signal message into cipher, the marking of the Ardois keyboard is on no account to be changed to accomplish this effect.

TESTIMONIALS.

September

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:—I have received for the use of myself and officers three copies of The Navigator or Mariner's Guide, 3d Edition. I thank you most heartily for this, for I know what a large call you must have for this valuable publication. Several years ago we had a few copies and certainly appreciated them and used them a great deal. I trust that we may be able at some time to reciprocate.

Yours truly,
E. HILL, Jr., Commander C. N. G.,
Connecticut Naval Reserve.

Philadelphia, Pa.

Mr. Harry Louderbough, Jersey City, N. J.

Dear Sir:—I wish to state to you the wonderful results I received from your "New Jersey Copper Paint" which I have already used twice on my yacht, the Lillian D. In the spring of 1909 I first used your paint on the bottom of my hull and would have lasted all summer, but last winter I had her thoroughly overhauled and thought it would not look right to bring her out of the shipyard without having her painted. This season all I have to do is to get the hull scrubbed off to remove the mud and she looks just as good as the first day she went over last spring, after all of the rough wear and tear she received last summer down the Delaware Bay.

Yours very truly,
P. DOERSAN,
517 Jefferson St., Philadelphia,

New York City.

New Jersey Paint Works,

Mr. Harry Louderbough, Prop., Jersey City, N.J.

Gentlemen:—In the spring I shall again paint my boats and you may rest assured that it will be with "New Jersey" Brand, as I consider your paints representative of the best.

Yours truly,
JOS. W. KEEFE, Captain, Cruiser Kathryn-K.

Pelham Bay, N. Y.

Army and Navy Y. M. Christian Association.
"With the Colors."

New Jersey Paint Works, Jersey City, N. J.

Dear Sirs:—Will you kindly advise me where I can obtain the new edition of your "Mariner's Guide." My 1902 copy is fast falling apart and a short while ago I had the opportunity to look through your new edition but could not learn where I could purchase same. Thanking you in advance, I remain,

Yours respectfully,
RICHARD TOBIN, 2nd Regiment,
Naval Station.

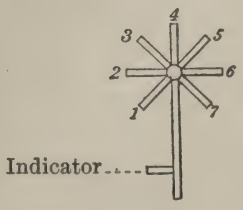
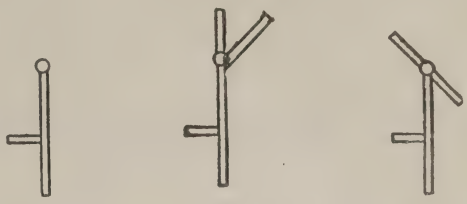
Malone, N. Y.

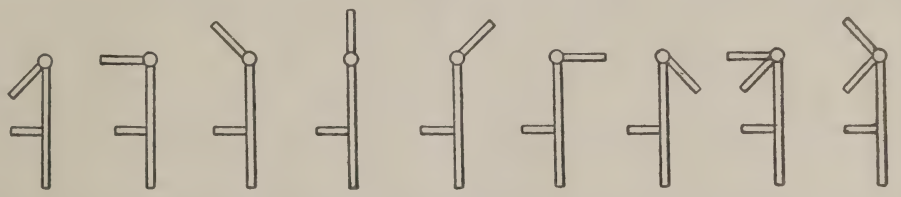
New Jersey Paint Works, Jersey City, N. J.

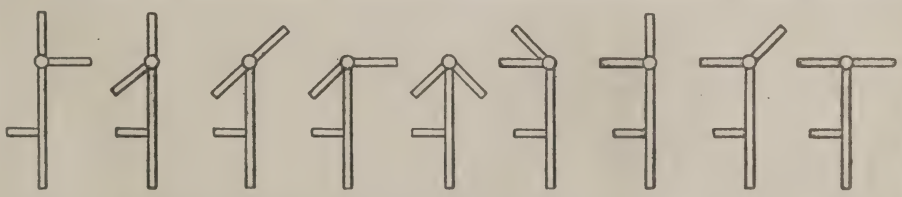
Gentlemen:—I have used both your "Yacht White" and the "New Jersey Special Red Copper" for close to twenty years, I naturally am adverse to making any experiments with other brands at this stage of the game.

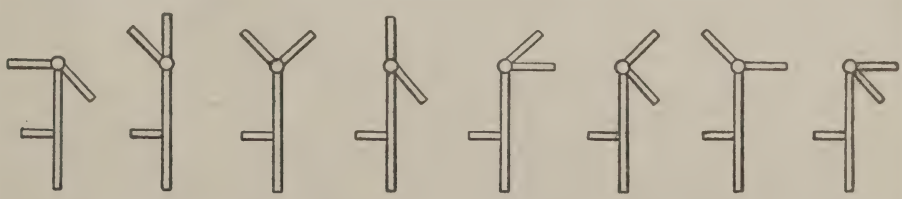
Very truly yours,
A. C. RAUTERBERG, M. D.

THE TWO ARM SEMAPHORE CODE.

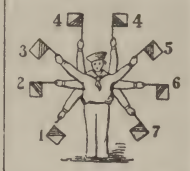
SEMAPHORE SIGNS.	GOVERNING SIGNS			
		INTERVAL		LETTERS FOLLOW	SIGNALS FOLLOW

SIGNS.								
Alphabetical Signification.	A	B	C	D	E	F	G	H	I
Numerical Signification.	1	2	3	4	5	6	7	8	9

SIGNS.								
Alphabetical Signification.	J	K	L	M	N	O	P	Q	R
Numerical Signification.	0	Negative	Preparatory		Annulling	Interrogatory	Affirmative		Acknowledge

SIGNS.								
Alphabetical Signification.	S	T	U	V	W	X	Y	Z

THE TWO ARM SEMAPHORE WITH HAND FLAGS.



SIGNS.						
Alphabetical Signification.	A	B	C	D	E	F
Numeral Signification.	1	2	3	4	5	6
SIGNS.						
Alphabetical Signification.	G	H	I	J	K	L
Numeral Signification.	7	8	9	0	NEGATIVE	PREPARATORY
SIGNS.						
Alphabetical Signification.	M	N ANNULLING	O Interrogatory	P Affirmative	Q	R Acknowledge
SIGNS.						
Alphabetical Signification.	S	T	U	V	W	X
SIGNS.						
Signification.	Y	Z			LETTERS FOLLOW	SIGNALS FOLLOW

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JERSEY CITY, N. J., U. S. A.

AMERICA'S CUP

THE AMERICA'S CUP.

This cup was won by the yacht "America" at the regatta of the Royal Yacht Squadron around the Isle of Wight, England, on August 22, 1851. It was offered to and accepted by the New York Yacht Club on July 8, 1857, as a perpetual international challenge cup. Deeded again to them on January 4, 1882, and again on October 28, 1887, and has been held by them since that time.

THE AMERICA'S CUP RECORD OF RACES

See Opposite Page

DATE	NAME	OWNER	COURSE	AL'OWS	Won
Aug. 22, 1851	AMERICA..... AURORA.....	G. L. Schuyler..... T. LeMerchant.....	From Cowes around Isle of Wight (AURORA second)	———	M. S. 18.00
Aug. 8, 1870	MAGIC..... CAMBRIA.....	Franklin Osgood..... J. Ashbury	N. Y. Y. C. Course (CAMBRIA tenth)	———	39.12.7
Oct. 26, 1871	COLUMBIA..... LIVONIA.....	Franklin Osgood..... J. Ashbury.....	N. Y. Y. C. Course	———	27.04
Oct. 18, 1871	COLUMBIA..... LIVONIA.....	Franklin Osgood..... J. Ashbury.....	20 miles to windward off Sandy Hook Lightship and return	———	10.33¾
Oct. 19, 1871	LIVONIA..... COLUMBIA.....	J. Ashbury..... Franklin Osgood.....	N. Y. Y. C. Course (COLUMBIA disabled)	———	15.10
Oct. 21, 1871	SAPPHO ..... LIVONIA.....	W. P. Douglas..... J. Ashbury.....	20 miles to windward off Sandy Hook Lightship and return	———	33.21
Oct. 23, 1871	SAPPHO ..... LIVONIA.....	W. P. Douglas..... J. Ashbury.....	N. Y. Y. C. Course	———	25.27
Aug. 11, 1876	MADELEINE... COUNTESS OF DUFFERIN	J. S. Dickerson..... Major C. Gifford.....	N. Y. Y. C. Course	———	10.59
Aug. 12, 1876	MADELEINE... COUNTESS OF DUFFERIN	J. S. Dickerson..... Major C. Gifford.....	20 miles to windward off Sandy Hook Lightship and return	———	27.14
Nov. 9, 1881	MISCHIEF..... ATALANTA....	J. R. Busk..... Alex. Cuthbert.....	N. Y. Y. C. Course	———	28.20¼
Nov. 10, 1881	MISCHIEF..... ATALANTA....	J. R. Busk..... Alex. Cuthbert.....	16 miles to leeward from Buoy 5 off Sandy Hook and return	———	38 54
Sept. 14, 1885	PURITAN..... GENESTA.....	J. Malcolm Forbes.... Sir Richard Sutton...	N. Y. Y. C. Course.....	——— 0.28	16.19
Sept. 16, 1885	PURITAN..... GENESTA.....	J. Malcolm Forbes.... Sir Richard Sutton...	20 miles to leeward off Sandy Hook Lightship and return	——— 0.38	1.08
Sept. 9, 1886	MAYFLOWER.. GALATEA.....	Gen. C. J. Paine ..... Lieut. Henn, R. N....	N. Y. Y. C. Course	——— 0 38	12.02
Sept. 11, 1886	MAYFLOWER.. GALATEA	Gen. C. J. Paine ..... Lieut. Henn, R. N....	20 miles to leeward off Sandy Hook Lightship and return	——— 0.39	29.09
Sept. 27, 1887	VOLUNTEER.. THISTLE	Gen. C. J. Paine ..... James Bell.....	N. Y. Y. C. Course	——— 0 05	19 23¾
Sept. 30, 1887	VOLUNTEER.. THISTLE	Gen. C. J. Paine..... James Bell.....	20 miles to leeward off Scotland Lightship and return	——— 0.06	11 48¾
Oct. 7, 1893	VIGILANT..... VALKYRIE II..	C. Oliver Iselin *et al*.. Lord Dunraven.....	15 miles to windward off Scotland Lightship and return	——— 1.48	5.48
Oct. 9, 1893	VIGILANT..... VALKYRIE II..	C. Oliver Iselin *et al*. Lord Dunraven.....	N. Y. Y. C. Course—Equilateral Triangle—30 miles	——— 1 48	10 35
Oct. 13, 1893	VIGILANT .... VALKYRIE II..	C. Oliver Iselin *et al*.. Lord Dunraven	15 miles to windward off Scotland Lightship and return	——— 1.33	0.40
Sept. 7, 1895	DEFENDER ... VALKYRIE III.	C. Oliver Iselin *et al*.. Lord Dunraven.....	15 miles to windward off Scotland Lightship and return	0 29 ———	8.49
Sept. 10, 1895	DEFENDER.... VALKYRIE III.	C. Oliver Iselin *et al*.. Lord Dunraven.....	N. Y. Y. C. Course—Equilateral Triangle—30 miles	0 29 ———	0.47*
Sept. 12, 1895	DEFENDER.... VALKYRIE III.	C. Oliver Iselin *et al*.. Lord Dunraven.....	15 miles to windward and return from Sandy Hook Lightship	0 29 ———	†
Oct. 16, 1899	COLUMBIA..... SHAMROCK....	C. Oliver Iselin *et al*.. Sir Thomas Lipton....	15 miles E. S. E. from Sandy Hook Lightship and return—30 miles	——— 0.06	10.08
Oct. 17, 1899	COLUMBIA..... SHAMROCK....	C. Oliver Iselin *et al*.. Sir Thomas Lipton....	10 miles Triangular from Sandy Hook Lightship—30 miles	——— 0.06	§
Oct. 20, 1899	COLUMBIA..... SHAMROCK....	C. Oliver Iselin *et al*.. Sir Thomas Lipton....	15 miles S. by W. from Sandy Hook Lightship and return—30 miles	0.16 ———	6.34
Sept. 28, 1901	COLUMBIA..... SHAMROCK II..	J. Pierpont Morgan.. Sir Thomas Lipton....	15 miles to windward and return....	——— 0.43	1.20
Oct. 1, 1901	COLUMBIA..... SHAMROCK II..	J. Pierpont Morgan... Sir Thomas Lipton....	10 miles Triangular—30 miles.....	——— 0 43	3.35
Oct. 4, 1901	COLUMBIA..... SHAMROCK II..	J. Pierpont Morgan... Sir Thomas Lipton....	15 miles to windward and return....	——— 0 43	0.41
Aug. 22, 1903	RELIANCE..... SHAMROCK III	Wm. B. Duncan *et al*. Sir Thomas Lipton...	15 miles to windward and return....	——— 1.57	7.03
Aug. 25, 1903	RELIANCE..... SHAMROCK III	Wm. B. Duncan *et al* Sir Thomas Lipton...	10 miles Triangular—30 miles.....	——— 1.57	1.19
Sept. 3, 1903	RELIANCE .... SHAMROCK III	Wm. B. Duncan *et al*. Sir Thomas Lipton...	15 miles to windward and return....	——— 1.57	‡
July 15, 1920	RESOLUTE SHAMROCK IV	C. F. Adams *et al*.... Sir Thomas Lipton...	15 miles to windward and return...	——— 7.01	Disabled
July 20, 1920	RESOLUTE SHAMROCK IV	C. F. Adams *et al*.... Sir Thomas Lipton...	10 miles Triangular—30 miles.....	——— 7.01	2.26
July 21, 1920	RESOLUTE SHAMROCK IV	C. F. Adams *et al*.... Sir Thomas Lipton...	15 miles to windward and return...	——— 7.01	6.40
July 23, 1920	RESOLUTE SHAMROCK IV	C. F. Adams *et al*.... Sir Thomas Lipton...	10 miles Triangular—30 miles.....	——— 6.40	9.58
July 24, 1920	RESOLUTE SHAMROCK IV	C. F. Adams *et al*.... Sir Thomas Lipton...	15 miles to windward and return...	——— 6.40	19.36

*Disqualified for fouling Defender. †Withdrew on crossng the line. §Carried away topmast and withdrew. ‡Reliance finished just the time limit, Shamrock III did not finish.

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AMERICA WINNING THE QUEEN'S CUP, 1851.

The America.

This famous American yacht not only had the honor of proving herself the fastest vessel afloat by winning the trophy which British yachtsmen have made so many vain attempts to regain, but demonstrated to the whole world that American ingenuity and skill would continue its supremacy in sport as well as in commerce.

Mr. George Steers built the America in 1849 in that part of New York known as Williamsburg. He had constructed several pilot boats and other small craft which became famous the world over for speed; the result being that he was selected to design and build the yacht that won the prize in the most important racing event in the history of yachting. *Her victory brought the attention of many to the most manly of sports, the one requiring the greatest skill, and beyond any doubt, yachting in British and American waters has reached its present high standard as a result. Nothing else could have interested so many wealthy and influential people in the sport.

At the time the America was constructed and at the present time, the center of displacement was well forward of amidships; but Mr. Steers did not believe in such models and built the craft according to theories of his own, which were long lines fore and aft and a uniform displacement along the sides. He built the pilot boat Mary Taylor on those principles and she proved to be a very fast vessel. That and the unusual great dead-rise were the only peculiar or notable features of the craft which gave the British the greatest surprise since the days of Paul Jones.

The syndicate for whom the yacht was built was composed of J. C. Stevens, Edwin A. Stevens, Hamilton Wilkins, J. Beekman Finlay, and George L. Schuyler, all prominent yachtsmen and members of the New York Yacht Club.

That the America would be in the race of August 22, 1851 did not disturb the minds of British yachtsmen at all. When she arrived at Cowes, she had just proved her sailing qualities by beating badly the British yacht Laverock in an impromptu brush outside the harbor.

Commodore Stevens made a strong effort to get a race with some British yacht, but met with no success, as his vessel had in the meantime beaten several of the best British yachts in as many off-hand brushes. She was of little or no interest at first; but her speed being demonstrated on so many occasions, she began to be looked upon as an unknown quantity and finally as a dangerous rival, and therefore no race could be arranged.

The Commodore then posted a challenge in the Royal Yacht Squadron's Castle to sail the America against any British vessel of any size or tonnage for from one thousand to ten thousand guineas in a six-knot breeze. As this challenge was not accepted, it seems to indicate that British yachtsmen had lost what confidence they had in their fastest vessels and become convinced of the superiority of the America over anything they had in the way of fast yachts. As it was impossible to arrange for a race, Commodore Stevens decided to enter the schooner in the free-for-all race. This came off on August 22, 1851. The start was made from Cowes at 10 A. M., the whole fleet was at anchor when the signal to start was given. The American crew then showed their superior qualities as seamen by heaving up their anchor and setting all sail in an instant.

The yachts which started were: The three-masted schooner Brilliant, 392 tons; schooner Constance, 218 tons; schooner Wyvean, 205 tons; cutter Alarm, 193 tons; schooner Beatrice, 161 tons; schooner Gypsie Queen, 160 tons; cutter Arrow, 84 tons; cutter Mona, 82 tons; cutter Bacchante, 80 tons; schooner Ione, 75 tons; cutter Freak, 60 tons; cutter Eclipse, 50 tons; cutter Volanthe, 48 tons; cutter Aurora, 47 tons; and the America, which, according to the entry list, was 170 tons, making a total of fifteen yachts in the race.

The America soon showed her heels to the fleet, and at one time she was so far ahead that not a sail was visible from her decks; but the wind died down and she had to contend with a strong contrary tide, and the current not having reached the other yachts, they soon came in sight. After passing St. Catherine the wind had freshened, and the America, with lifted sheets, soon showed her heels the second time and arrived at Cowes a winner at 8.37 P. M. The next yacht to come in was the cutter Aurora, which arrived at 8.55 P. M. The America's time was 10 hours 37 minutes, in which time she covered a distance of about 55 miles.

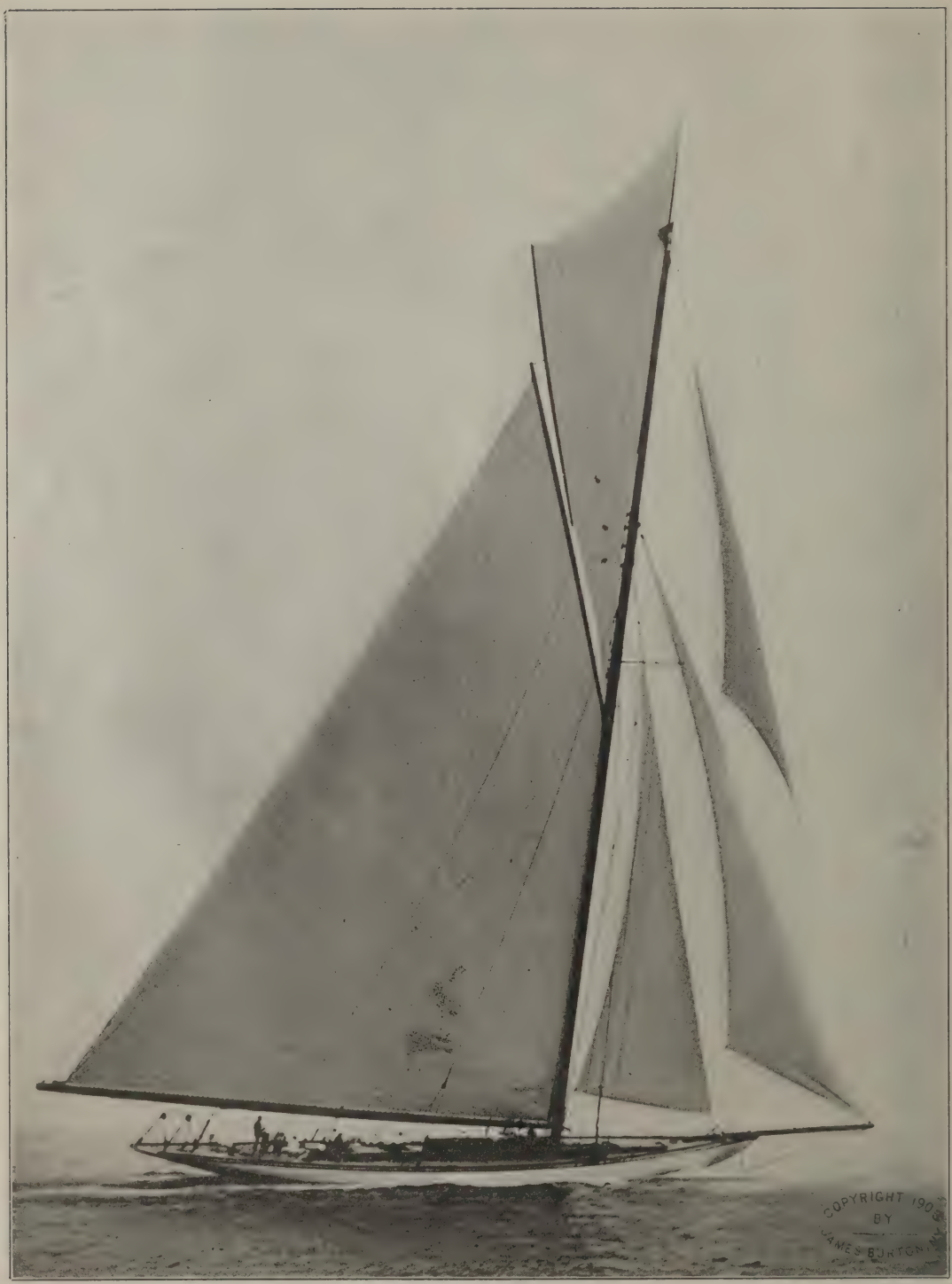
The only accidents of importance was the grounding of the cutter Arrow at St. Catherine and the loss of the America's jib-boom. The Arrow had no chance of winning, so her grounding did not matter, and the Americans cleared away the wreckage resulting from the loss of the jib-boom in a moment, and without jeopardizing her chances to win.

That the America had proven herself faster than any other craft in British waters at that time was conceded by yachtsmen generally; but some contended that they could build a yacht in a few weeks that would beat her. Then Commodore Stevens offered to wait until the boat was completed and race the America against her for $125,000.00. No one met this offer and the boat was not built, so British yachtsmen had not only lost confidence in their best boats, but in their skill to build one that would beat the America.

The British fleet did not relish the idea of being beaten, but it had the good effect of spurring them on, which greatly benefited them.

After the race a cartoon was published in Punch representing two boys—John and Jonathan—sailing toy boats, and Jonathan saying to John, "If you don't look sharp, I'll show you how to make a seventy-four next!"

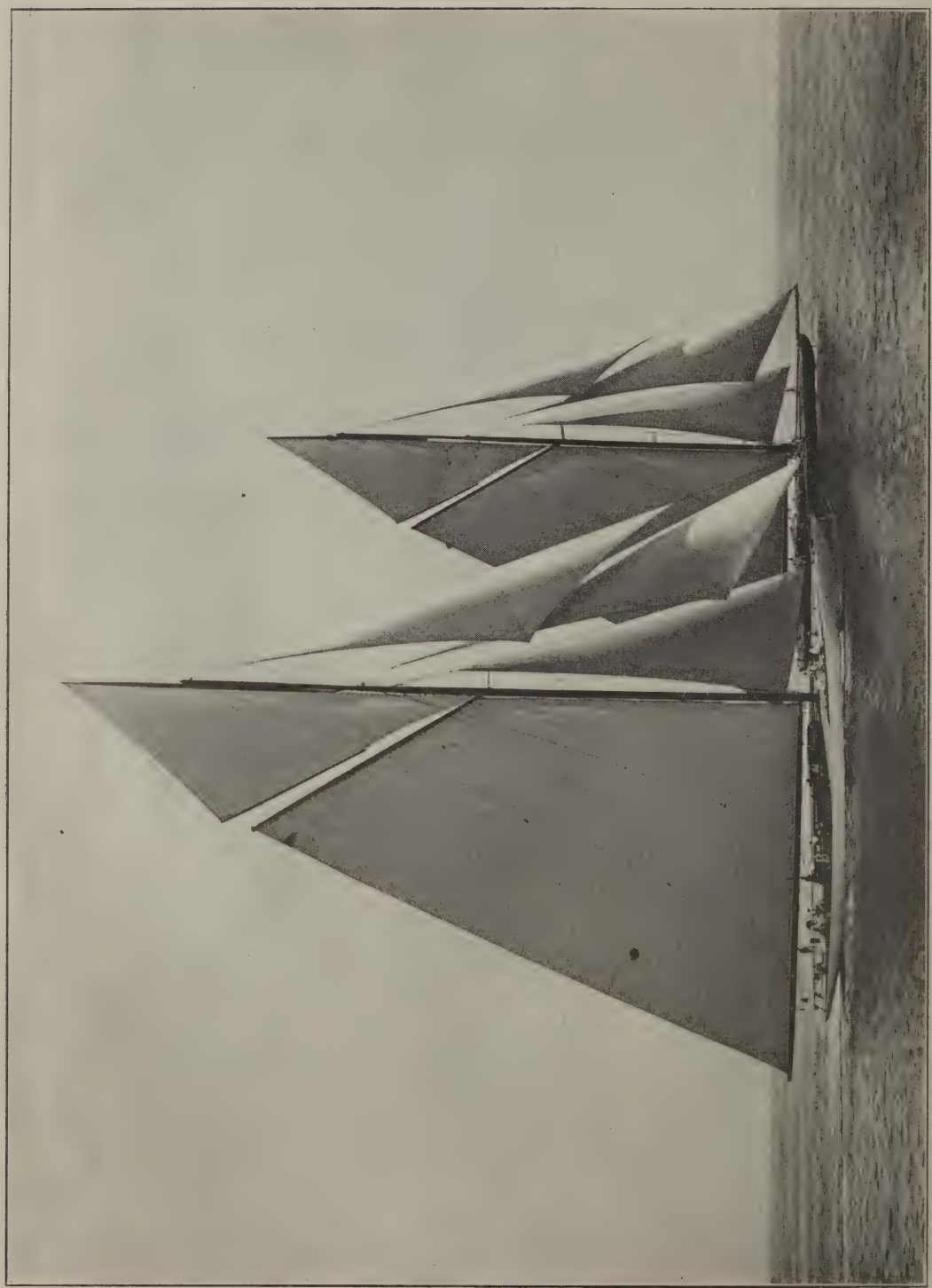
*She was rigged precisely like a pilot boat of that day, with a single jib, a big foresail, and no fore topsail; she had neither jib-boom, fore topmast or fore-boom. Dimensions of hull; length on deck, 94 feet; on water line, 88 feet; on keel, 82 feet; beam, 22 feet 6 inches; depth of hold, 9 feet 3 inches; draught of water, 11 feet 6 inches.



SHAMROCK III.

Copyright 1903, by Jas. Burton, N. Y.

RELIANCE.



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RESOLUTE AND SHAMROCK IV

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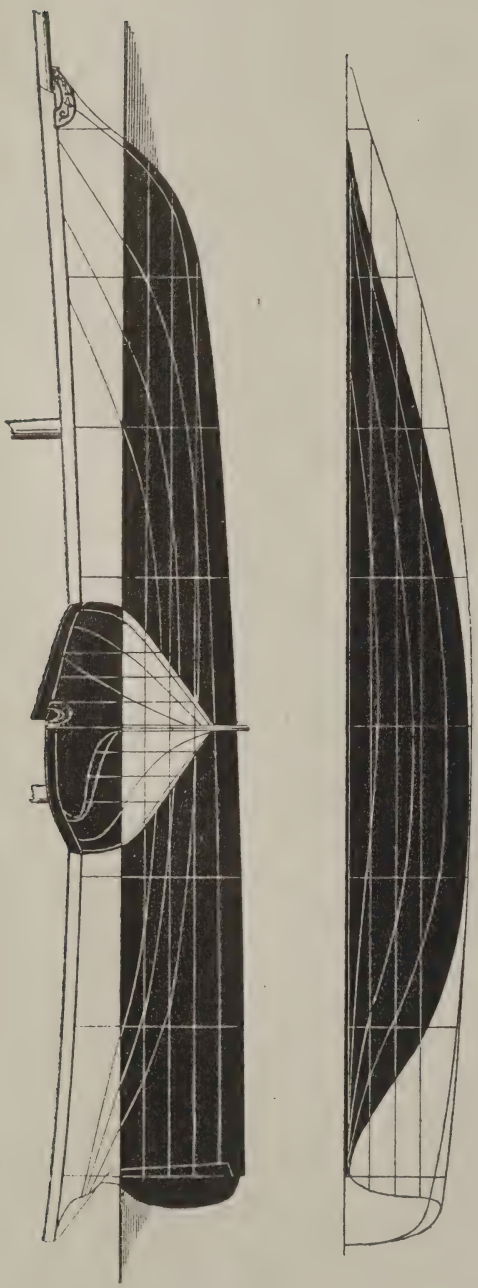
RESOLUTE



LINES OF YACHT AMERICA.

LINES OF YACHT SVERIGE (SWEDEN).

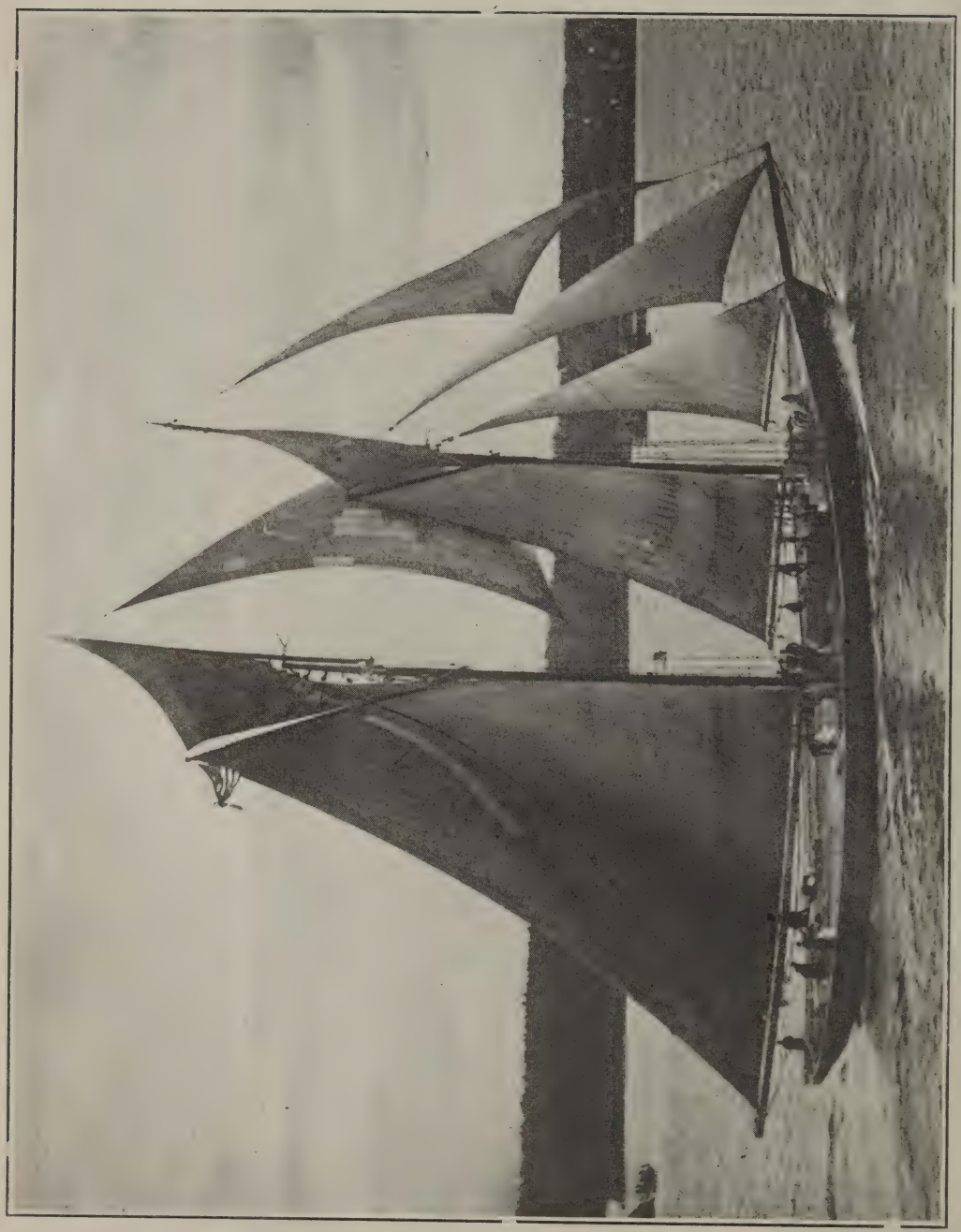
The Rudder.

SVERIGE, BUILT IN SWEDEN TO SAIL AGAINST THE AMERICA.

THE SWEDISH SCHOONER YACHT "SVERIGE."

This remarkably fast schooner was built at Essinger, Sweden, by Carl A. Anderson in 1852. She bears a strong resemblance to the America, which she raced off the Isle of Wight on October 12th of that year, outsailing the former for a long distance, but finally lost the race by the breaking of the jaws of her gaff. The general appearance of the two boats is so similar that we may assume that the designer of Sverige has at least taken his inspiration from the American pilot boats, which have retained the same general type before and for a time after America. The dimensions of Sverige were: length over all, 113 feet 10 inches; load water line, 96 feet; beam, extreme, 25 feet 8 inches, load water line, 24 feet 8 inches; draught, 11 feet 8 inches; displacement, long tons, 149.5; area, midship section, square feet, 102.

On the page opposite, the lines of both yachts, Sverige and America, are shown for comparison.



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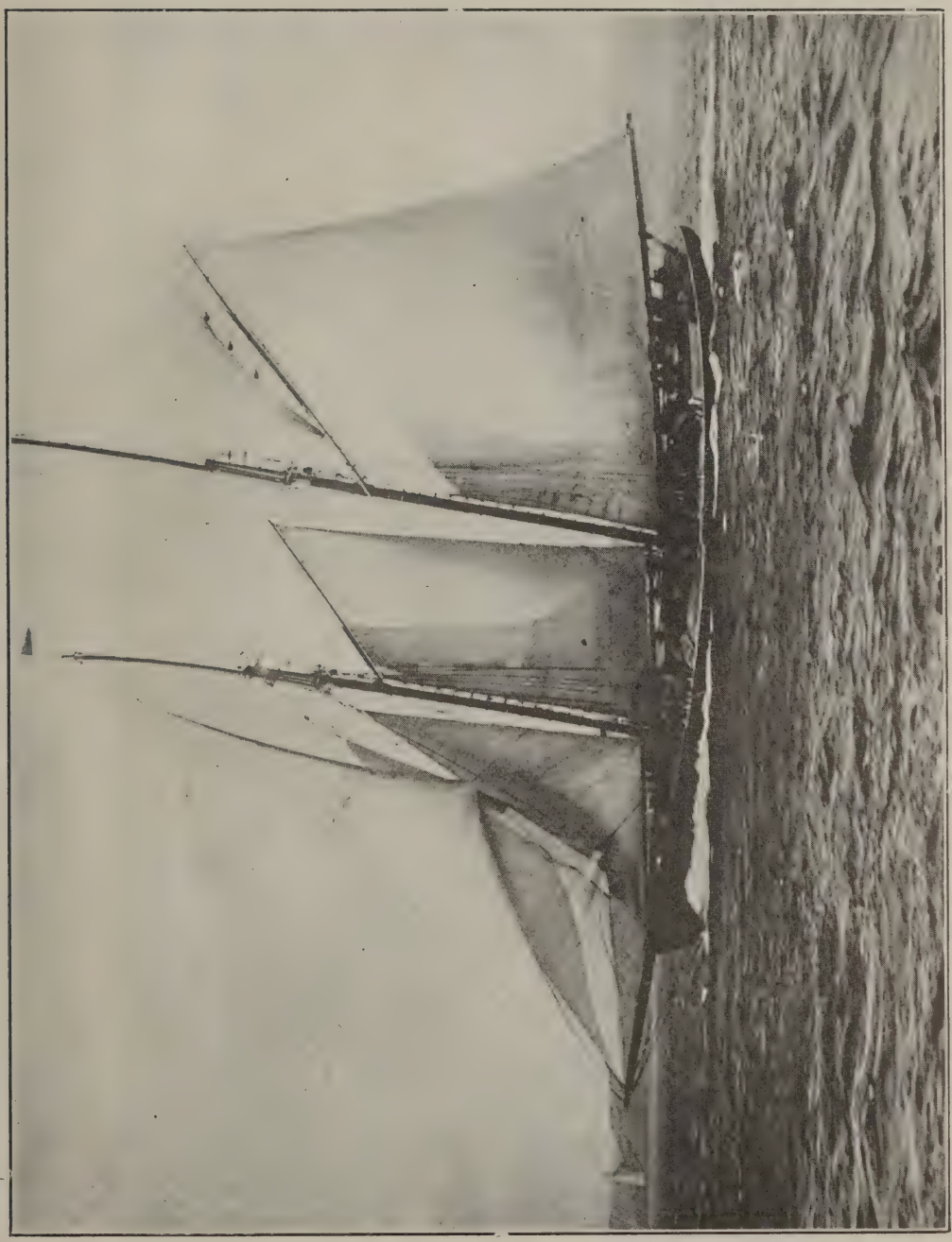
The Gloucester Fishing Schooner "ESPERANTO," Winner of the Fisherman's Race of 1920.



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"DELAWANNA," of the Nova Scotia Fleet, Canadian Champion in the Fisherman's Race of 1920

Courtesy "The Rudder" Photo C. H. J. Snider

The disqualified American Schooner **"Mayflower"** built especially for the Fishermen's Race of 1921 and protested; shown under sail with her four lower sails of winter rig with dories on deck so she looked like a lumber schooner; she met the racer on part of the course. She was bound to the banks and was 34 hours out of Boston. She had an impromptu brush with the Blue Nose and the Elsie during one of the races; but she headed away on her course and sailed almost as fast although she had no light sails.

Painted with "New Jersey" Yacht Red Copper Paint.

YACHTSMEN, AHOY!

LOOK AT OUR SPECIALTIES.

Ground Expressly for Yachts.

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Producing a Good Sailing Bottom.

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Very Bright.

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For Wood or Iron Bottoms.

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Ready Mixed and Paste Form.

A very fine black, being very intense in color and of splendid wearing qualities, and does not turn gray.

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Ready Mixed for Use.

In offering this preparation to yachtsmen it has been our aim to give them a paint adapted to their use, saving the labor of mixing, and made from such materials as to produce the desired results; not being too glossy or too flat, but of right consistency.

LEADS THEM ALL.
SO OUR TESTIMONIALS SAY.

Send for SAMPLE PAD showing Shades of our

PURE LINSEED OIL READY MIXED PAINTS.

These Paints are well adapted for use on all Club or Boat Houses, as they are not affected by sun, salt water or northern exposure.

MANUFACTURED BY

New Jersey Paint Works

HARRY LOUDERBOUGH, Inc.

JERSEY CITY N. J., U. S. A.

Courtesy ''The Rudder''

ELSIE, American contender of the Fisherman's Race of 1921, Captain Marty Welch, master.

Courtesy ''The Rudder''

BLUEROSE, Canadian Champion of the Fisherman's Race of 1921, Captain Eugene Walters, master.

Courtesy "The Rudder" Photo C. H. J. Snider

ELSIE STAGGERING along under full sail in a heavy breeze just after her foretopmast was carried away. Most Yachts would be down to double reefs in this weather.

System of Buoyage Adopted in United States Waters.

In approaching a channel from sea, red buoys with even numbers will be found on the starboard side of the channel, and must be left on the starboard hand in entering.

Black buoys are on the port side of the channel, and must be left on port hand in entering.

Buoys marking obstructions are painted with red and black horizontal stripes and may be left on either hand.

Buoys marking mid-channel are painted with white and black perpendicular stripes and must be passed close to, that danger may be avoided.

Buoys with perches, balls, cages, etc., mark turning points, the color and number indicating the hand they are to be left on.

Nun buoys are red with even numbers, and are to be left on the starboard hand in entering.

Can buoys are black with odd numbers and are to be left on the port hand in entering.

When buoys are lighted, those with red lights are to be left on the starboard hand and those with white lights on the port hand in entering.

Day beacons, stakes and spindles when placed on sides of channels, are colored like buoys, and when lighted at night, they are to be left the same as lighted buoys.

Bell and whistling buoys are usually placed to mark certain points, and their use is explained in the buoy book for the district.

There are numerous day marks which are constructed and distinguished with special reference to the locality in which they are placed, a description of which is usually given in the buoy book for the district.

White buoys are usually employed to mark anchorages, dumping grounds, etc., and as a rule, are explained in the U. S. Coast Pilot.

Yellow buoys are sometimes employed by the quarantine authorities to mark a station.

The Boatswain's Call.

On yachts carrying a good-sized crew the boatswain's call or whistle should be employed for the transmission of orders. The following simple code embraces all that is necessary for the boatswain to understand of this detail of yachting discipline:

The Call of Attention.—A long, straight pipe. This precedes a verbal order, such as "All hands on deck!" etc.

To Call Away a Boat.—Same as the "call of attention," and followed by the verbal order: "Away gig;" "Away dingy;" "Away cutter;" "Away lifeboat," etc.

The Call to Meals.—Three long, rolling pipes.

To Heave Away or to Pull.—A series of moderately short, straight pipes.

To Belay.—Two short, quick chirps, followed by a moderately short, rolling pipe.

To Pipe the Side.—A prolonged, straight pipe. The boatswain stands facing the gangway, his "call" held to his lips with his left hand, while his right hand is held to his cap in salute.

To Make Colors.—Two short, quick chirps, followed by a long, rolling pipe.

To Make Sunset.—Same as to "make colors."

To Pipe Down.—One long, straight pipe, followed by a long rolling pipe.

Don't Neglect the Lead.

The Allan liner Grecian, which went ashore at Sandwich Point, outside Halifax Harbor, was a total loss. The inquiry into the disaster has resulted in the dismissal of the pilot from the association and the suspension of the captain's certificate for three months.

The board of inquiry found the disaster to be due to the failure to use the lead. The night was squally, but not continuously blustery, and no very strong wind was blowing nor heavy seas running. There seems to have been no reason why the vessel was not brought safely into port, other than the culpability of the officers in charge to diligently cast the lead. The board overruled the contention that the captain's responsibility ceases when the pilot comes on board, but held that he is equally responsible with the pilot in bringing the vessel safely to land. Therefore, it is incumbent upon him to use every precaution in navigating his ship the same as he would be expected to do had he no pilot on board.

The inquiry brings out forcibly the need of a frequent and intelligent use of the lead, a matter which too many navigators are prone to neglect. Even within recent years, two big steamers and one sailing vessel have gone ashore on the south side of Long Island within a few miles of each other, where the soundings are as regular in increasing depth from the beach to deep water as a ship railway; yet in neither of these cases has there been any mention made of close attention to the lead. Volumes have been written, underwriters have urged, and shipowners have begged that the lead receive the attention due to it, but all to no avail with a certain class of mariners who are seldom found out until they have caused serious loss in property and too often in lives.

To Mark a Lead Line.

The hand lead has nine marks and eleven deeps, and is marked to twenty fathoms. as follows:

2 fathoms, two strips of leather.
3 fathoms, three strips of leather.
5 fathoms, white cotton rag.
7 fathoms, red woolen rag.
10 fathoms, leather with one round hole.
13 fathoms, blue woolen rag.
15 fathoms, white cotton rag.
17 fathoms, red woolen rag.
20 fathoms, leather with two round holes.

The deep sea lead is marked the same as the hand lead up to twenty fathoms and from there it is marked every five fathoms with one knot, and every ten fathoms with two knots up to one hundred fathoms which is marked with a piece of leather.

Some marks are woolen rags and some are cotton rags that they may be distinguished at night by putting the mark in the mouth.

A lead line should be of the same material as is used for log lines, and must be thoroughly wet when marked.

Table for Correcting Soundings.

This table is used for correcting soundings for the height of the tide above mean low water. The first column contains the range of the tide in feet. The other columns give the height of the tide above low water, corresponding to each hour.

Range of tide in feet.	Hours from High or Low Tide.					
	1	2	3	4	5	6
2	0.0	0.5	1.0	1.5	2.0	2.0
4	0.2	1.0	2.0	3.0	3 8	4 0
6	0.4	1.5	3.0	4 5	5 6	6.0
8	0 5	2.0	4.0	6.0	7 5	8.0
10	0.7	2.5	5.0	7.5	9 3	10.0
12	0.8	3 0	6.0	9 0	11.2	12.0
14	0.9	3 5	7.0	10.5	13 1	14.0
16	1.1	4.0	8.0	12.0	14 9	16 0
18	1.2	4.5	9.0	13.5	16 8	18.0
20	1.3	5.0	10.0	15.0	18.7	20 0
22	1.5	5.5	11.0	16.5	20.5	22 0
24	1.6	6.0	12.0	18.0	22 4	24 0
26	1.7	6.5	13 0	19.5	24 3	26 0
28	1.9	7.0	14.0	21.0	26 1	28 0
30	2.0	7.5	15.0	22.5	28.0	30.0
32	2.1	8.0	16.0	24.0	29.9	32 0
34	2.3	8.5	17.0	25.5	31.7	34 0
36	2.4	9.0	18.0	27.0	33 6	36 0
38	2.5	9.5	19.0	28.5	35 5	38.0
40	2.6	10.0	20.0	30.0	37 4	40 0

Example: At a place where the depth of water as shown by the chart is three fathoms at mean low water, what will the depth be at two hours after low water? Range of tide, eight feet.

Depth given on the chart, 3 fathoms	18 feet.
Correction from table for 2 hours and 8 feet	+ 2 "
Ans.	20 feet.

Example: At high water a cast of the lead gave a depth of twenty-four feet. What will the depth be at four hours after high water? Range of tide, twelve feet.

Sounding	24 feet.
Correction from table for 4 hours and 12 feet	— 9 "
Ans.	15 feet.

TESTIMONIALS.

Elizabeth City, N. C.

Mr. H. Louderbough.

Dear Sir.—Having used and sold your New Jersey Copper Paint at my Railway ever since you first introduced it to the trade, and never having heard a complaint against it, it affords me pleasure to add my testimonial to the many you have already received, to the effect that all who wish to keep worms out, and have a clean, smooth sailing bottom on their boats, will do well to use New Jersey Copper Paint.

Very truly yours, E. S. WILEY.

Chincoteague, Va.

Mr. H. Louderbough.

Dear Sir.—I can cheerfully testify to the good merits of your very popular brands of "New Jersey Brown Copper Paint, and "New Jersey" Yacht Red Copper Paint. Even in the very bad fouling waters of our bay it has made for itself, in competition with other paints, a splendid reputation, and I have good endorsements from those who purchase from year after year.

Yours truly,

W. N. CONANT.

Signals to the Engine Room.

When engines are stopped, one bell means—AHEAD SLOW.

When engines are working ahead slow, jingle bell means—FULL SPEED AHEAD.

When engines are working full speed ahead, one bell means—SLOW DOWN.

When engines are working ahead slow, one bell means—STOP.

When engines are stopped, two bells means—ASTERN SLOW.

When engines are working astern slow, jingle bell means—FULL SPEED ASTERN.

When engines are working astern either slow or full speed, one bell means—STOP.

When engines are working full speed ahead, four bells mean—ASTERN. With jingle bell, FULL SPEED ASTERN.

Handling Steam-Vessels.

The helm should never be put hard over when the ship is running full speed unless it is absolutely necessary, the effect being an enormous strain on the engines and rudder, which has been known to result in blowing off cylinder heads, breaking the shaft, damaging the rudder, etc. The greatest strain is with a port helm. This danger varies with the speed of the ship.

When a ship starts from an anchorage or a dock, full speed should not be expected at once, because the engines must be warmed and the water worked out before they can be driven.

When it is intended to stop or slow the ship, as in entering port or coming to an anchor, and when the ship must go through shoal water, the chief engineer should have at least an hour notice if possible, as such information is invariably of value to him.

Engines working ahead, throw the stern to starboard; and when working astern, throw the stern to port.

When running, the propeller sets the ship to starboard of her course and is called the set of the screw. It then follows that a ship will make more leeway on the port tack than when on starboard tack.

To bring a ship to a full stop when running full speed ahead, put the helm hard to port and at the same time reverse the engine to full speed astern; but never expect the engines to work astern as fast as they do ahead.

In making a sharp turn to port in a river or bay, bring the ship to a full stop near the turning point and then work the engine full speed ahead with starboard helm. To make the turn to starboard, run full speed till near the turning point, and then work the engine full speed astern with port helm.

TWIN SCREW.

In a twin-screw ship it is seldom necessary to work the engines full speed and in opposite directions, and it should never be done if possible to avoid it, as it subjects the machinery and hull to an unusually great strain and generally does more or less damage. The ship can be handled by working one engine at a time.

The starboard propeller has the same effect as in a single-screw ship, and the port one has the opposite.

Bell Time on Shipboard.

Time, A. M.	Time, A. M.	Time, A. M.	Time, P. M.	Time, P. M.	Time, P. M.
1 Bell....12.30	1 Bell.....4.30	1 Bell.... 8.30	1 Bell.. .12.30	1 Bell.....4.30	1 Bell.... 8.30
2 Bells... 1.00	2 Bells....5.00	2 Bells... 9.00	2 Bells... 1.00	2 Bells....5.00	2 Bells... 9.00
3 " ... 1.30	3 " 5.30	3 " ... 9.30	3 " ... 1.30	3 " 5.30	3 " ... 9.30
4 " ... 2.00	4 " 6.00	4 " ...10.00	4 " ... 2.00	4 " 6.00	4 " ...10.00
5 " ... 2.30	5 " 6.30	5 " ...10.30	5 " ... 2.30	5 " 6.30	5 " ...10.30
6 " ... 3.00	6 " 7.00	6 " ...11.00	6 " ... 3.00	6 " 7.00	6 " ...11.00
7 " ... 3.30	7 " 7.30	7 " ...11.30	7 " ... 3.30	7 " 7.30	7 " ...11.30
8 " ... 4.00	8 " 8.00	8 " .. Noon	8 " ... 4.00	8 " 8.00	8 " Midnight

On shipboard, for purpose of discipline and to divide the watch fairly, the crew is mustered in two divisions, the Starboard (right side, looking toward the head) and the Port (left). The day commences at noon, and is thus divided: Afternoon Watch. noon to 4 P. M.; First Dog Watch, 4 P. M. to 6 P. M.; Second Dog Watch, 6 P. M. to 8 P. M.; First Watch, 8 P. M. to Midnight; Middle Watch, 12 A. M. to 4 A. M.; Morning Watch, 4 A. M. to 8 A. M.; Forenoon Watch, 8 A. M. to noon. This makes seven Watches, which enables the crew to keep them alternately, as the Watch which comes on duty at noon one day has the afternoon next day, and the men who have only four hours' rest one night have eight hours the next. This is the reason for having Dog Watches, which are made by dividing the hours between 4 P. M. and 8 P. M. into two Watches. Time is kept by means of "Bells," although sometimes there is but one Bell on the ship.—Whitaker.

Stowage of Cargo.

Before any cargo is put into the ship, the hold must be cleaned and the limbers, water courses, scuppers and pump wells cleared. For general cargo dunnage is required as follows: 14 inches in the bilges, 3 inches in the sides and 2 inches between decks. In the hold the dunnage is placed fore and aft and athwartships in between decks.

Tar, resin, oil and other cargo of like nature should be stowed under dry cargo to prevent damage in case of leaky barrels.

Spirits and valuable cargo of such nature as are usually tempting to dishonest persons, should be stowed in such place as is not accessible during the voyage.

Casks should be stowed fore and aft, bilge and cantline, bung up and bilge free. Barrels are constructed with their head pieces vertical when they are bung up. The bung and rivets in the hoops are always in line.

Bales should be stowed on their flat amidship with marks and numbers up, and on their edge in the wings with marks and numbers inboard.

In stowing cases, the side bearing the mark is termed the top and should be stowed that side up.

Rails, pig iron and like cargo should be stowed in such manner as not to have too much of it in the bottom of the ship, as it will cause her to labor very heavily. A rough rule is to put two thirds of it in the lower hold and the balance in between decks and tom it down. This rule will apply to some vessels, while in others it is quite different.

Acids should be stowed on deck and in case of breakage they must be thrown overboard if possible.

When working cargo, the ship must be kept on an even keel.

Never disturb damaged cargo until it has been surveyed.

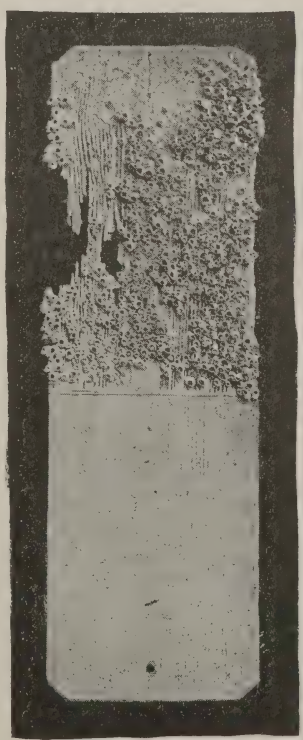
BACK LABEL IN FRENCH.

UNE MERVEILLE!

VOICI une copie de photographie d'une planche, dont l'un des deux bouts est au naturel tandis que l'autre est peint de **NEW JERSEY COPPER PAINT,** couleur fabriquée de cuivre. C'est de la fabrication de HARRY LOUDERBOUGH, propriétaire du NEW JERSEY PAINT WORKS, l'usine située à Jersey City en New Jersey. Cette planche fut mise à l'eau salée à Port Royal, en South Carolina, et y resta cinq mois. Voyons donc le bout sans couleur, comme il est rongé de vers, et quel grand nombre de moraillles s'y sont attachées! tandis que le bout peint de cette merveilleuse couleur de cuivre reste tout a fait intact.

La planche que voici a été mise dans l'eau à Port Royal, S. C., par mes propres mains. Elle y est restée pendant cinq mois, à la fin desquels le bout peint était en aussi bon état que quand elle y fut mise.

Déposé par MILLS EDWARD,
Maitre du Schooner "Florence Shay."



PEINTURE DE CUIVRE
DE
NEW JERSEY.

ESPECIALITÉS
DE NOTRES
Peintures pour la Marine.

NEW JERSEY.

- PEINTURES DE CUIVRE
- PEINTURE rouge de cuivre **Pour les yats.**
- PEINTURE elastique pour coutures.
- NOIR pour les YATS.
- BLANCHE pour les YATS.
- PEINTURE pour les Màts.
- Peinture pour les chimenees.
- PEINTURE pour casque et pontes de bateau.

L'Institute Americaine de New York accordàt a notres Peintures de Cuivre, et pour les coutures de bateau et preservatives de pilotes, la medaille de merite; le plus haute honneur accordè.

LOADING TABLE.—This table is calculated on the AMERICAN gallon of 8.333 lbs. and ton of 2000 lbs.

THIS SHOULD BE Lbs.	Oz.	Weight of 7½ Gallons of DOCK Water in Lbs.	Oz.	TONS OF CARGO IN SHIP WHEN SALT WATER DRAUGHT IS REACHED																			
				50	100	200	300	400	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000
62	7	62	8	1.25	2.50	5.00	7.50	10.00	12.50	25.	50.	75.	100.	125.	150.	175.	200.	225.	250.	275.	300.	325.	350.	375.	400.
62	8	62	9	1.20	2.40	4.80	7.20	9.60	12.00	24.	48.	72.	96.	120.	144.	168.	192.	216.	240.	264.	288.	312.	336.	360.	384.
62	9	62	10	1.15	2.30	4.60	6.90	9.20	11.50	23.	46.	69.	92.	115.	138.	161.	184.	207.	230.	253.	276.	299.	324.	345.	368.
62	10	62	11	1.10	2.20	4.40	6.60	8.80	11.00	22.	44.	66.	88.	110.	132.	154.	176.	198.	220.	242.	264.	286.	308.	330.	352.
62	11	62	12	1.05	2.10	4.20	6.30	8.40	10.50	21.	42.	63.	84.	105.	126.	147.	168.	189.	210.	231.	252.	273.	294.	315.	336.
62	12	62	13	1.00	2.00	4.00	6.00	8.00	10.00	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	300.	320.
62	13	62	14	.95	1.90	3.80	5.70	7.60	9.50	19.	38.	57.	76.	95.	114.	133.	152.	171.	190.	209.	228.	247.	266.	285.	304.
62	14	62	15	.90	1.80	3.60	5.40	7.20	9.00	18.	36.	54.	72.	90.	108.	126.	144.	162.	180.	198.	216.	234.	252.	270.	288.
62	15	63	0	.85	1.70	3.40	5.10	6.80	8.50	17.	34.	51.	68.	85.	102.	119.	136.	153.	170.	187.	204.	221.	238.	255.	272.
63	0	63	1	.80	1.60	3.20	4.80	6.40	8.00	16.	32.	48.	64.	80.	96.	112.	128.	144.	160.	176.	192.	208.	224.	240.	256.
63	1	63	2	.75	1.50	3.00	4.50	6.00	7.50	15.	30.	45.	60.	75.	90.	105.	120.	135.	150.	165.	180.	195.	210.	225.	240.
63	2	63	3	.70	1.40	2.80	4.20	5.60	7.00	14.	28.	42.	56.	70.	84.	98.	112.	126.	140.	154.	168.	182.	196.	210.	224.
63	3	63	4	.65	1.30	2.60	3.90	5.20	6.50	13.	26.	39.	52.	65.	78.	91.	104.	117.	130.	143.	156.	169.	182.	195.	208.
63	4	63	5	.60	1.20	2.40	3.60	4.80	6.00	12.	24.	36.	48.	60.	72.	84.	96.	108.	120.	132.	144.	156.	168.	180.	192.
63	5	63	6	.55	1.10	2.20	3.30	4.40	5.50	11.	22.	33.	44.	55.	66.	77.	88.	99.	110.	121.	132.	143.	154.	165.	176.
63	6	63	7	.50	1.00	2.00	3.00	4.00	5.00	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.	110.	120.	130.	140.	150.	160.
63	7	63	8	.45	.90	1.80	2.70	3.60	4.50	9.	18.	27.	36.	45.	54.	63.	72.	81.	90.	99.	108.	117.	126.	135.	144.
63	8	63	9	.40	.80	1.60	2.40	3.20	4.00	8.	16.	24.	32.	40.	48.	56.	64.	72.	80.	88.	96.	104.	112.	120.	128
63	9	63	10	.35	.70	1.40	2.10	2.80	3.50	7.	14.	21.	28.	35.	42.	49.	56.	63.	70.	77.	84.	91.	98.	105.	112.
63	10	63	11	.30	.60	1.20	1.80	2.40	3.00	6.	12.	18.	24.	30.	36.	42.	48.	54.	60.	66.	72.	78.	84.	90.	96.
63	11	63	12	.25	.50	1.00	1.50	2.00	2.50	5.	10.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.	65.	70.	75.	80.
63	12	63	13	.20	.40	.80	1.20	1.60	2.00	4.	8.	12.	16.	20.	24.	28.	32.	36.	40.	44.	48.	52.	56.	60.	64.
63	13	63	14	.15	.30	.60	.90	1.20	1.50	3.	6.	9.	12.	15.	18.	21.	24.	27.	30.	33.	36.	39.	42.	45.	48.
63	14	63	15	.10	.20	.40	.60	.80	1.00	2.	4.	6.	8.	10.	12.	14.	16.	18.	20.	22.	24.	26.	28.	30.	32.
63	15	64	0	.05	.10	.20	.30	.40	.50	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
64	0	64	1	.00	.00	.00	.00	.00	.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EXAMPLE.—A ship draws 19 feet in sea water. In fresh water she was loaded to that draught with 3750 tons. How much more cargo must she take on board to be fully loaded?

Under	3000	tons	and opposite	62 lbs.	8 oz.	72.00 tons
"	500	"	"	62 "	8 "	12.00 "
"	200	"	"	62 "	8 "	4.80 "
"	50	"	"	62 "	8 "	1.20 "
Additional cargo required to finish loading						90.00 " instead of 93.75 tons

Courtesy of
ROBERT W. BOXILL
Greenock, Scotland

LOADING TABLE.—This table is calculated on the ENGLISH gallon of 10 lbs. and ton of 2240 lbs.

Weight of 6¼ Gallons of DOCK Water in Lbs. Oz	TONS OF CARGO IN SHIP WHEN SALT WATER DRAUGHT IS REACHED.																							
	25	50	100	200	300	400	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
62 8	.586	1.172	2.344	4.688	7.032	9.376	11.720	23.440	46.88	70.32	93.76	117.20	140.64	164.08	187.52	210.96	234.40	257.84	281.28	304.72	328.16	351.60	375.04	398.48	421.92
62 9	.561	1.123	2.246	4.492	6.738	8.984	11.230	22.460	44.92	67.38	89.84	112.30	134.76	157.22	179.68	202.14	224.60	247.06	269.52	291.98	314.44	336.90	359.36	381.82	404.28
62 10	.534	1.069	2.138	4.277	6.416	8.555	10.694	21.388	42.77	64.16	85.54	106.94	128.32	149.71	171.08	192.49	213.88	235.26	256.64	278.03	299.42	320.79	342.16	363.57	384.98
62 11	.512	1.025	2.050	4.100	6.151	8.201	10.252	20.504	41.00	61.51	82.00	102.52	123.02	143.52	164.00	184.53	205.04	225.54	246.04	266.54	287.04	307.52	328.00	348.53	369.06
62 12	.488	.976	1.952	3.905	5.858	7.811	9.764	19.528	39.05	58.56	78.10	97.60	117.12	136.64	156.20	175.75	195.28	214.72	234.24	253.76	273.28	292.84	312.40	331.95	351.50
62 13	.463	.927	1.855	3.710	5.565	7.420	9.276	18.552	37.10	53.65	74.20	92.76	111.30	129.86	148.40	166.96	185.52	204.06	222.60	241.16	259.72	278.26	296.80	315.36	333.92
62 14	.439	.878	1.757	3.515	5.272	7.030	8.788	17.576	35.15	52.72	70.30	87.88	105.44	123.03	140.60	158.18	175.76	193.32	210.88	228.47	246.06	263.63	281.20	298.78	318.36
62 15	.415	.830	1.660	3.320	4.980	6.640	8.300	16.600	33.20	49.80	66.40	83.00	99.60	116.20	132.80	149.40	166.00	182.60	199.20	215.80	232.40	249.00	265.60	282.20	298.80
63 0	.390	.781	1.562	3.124	4.687	6.249	7.812	15.624	31.24	46.87	62.48	78.12	93.74	109.36	124.96	140.61	156.24	171.86	187.48	203.10	218.72	234.32	249.92	265.57	281.22
63 1	.366	.732	1.464	2.928	4.393	5.857	7.322	14.644	29.28	43.93	58.56	73.22	87.86	102.50	117.12	131.79	146.44	161.08	175.72	190.36	205.00	219.62	234.24	248.91	263.58
63 2	.341	.683	1.366	2.733	4.100	5.467	6.834	13.668	27.33	41.00	54.67	68.34	82.00	95.67	109.34	123.00	136.68	150.34	164.00	177.67	191.34	205.01	218.68	232.34	246.00
63 3	.317	.634	1.269	2.539	3.808	5.078	6.348	12.696	25.39	38.08	50.78	63.48	76.16	88.87	101.56	114.24	126.96	139.64	152.32	165.03	177.74	190.43	203.12	215.80	224.48
63 4	.292	.585	1.171	2.343	3.514	4.686	5.858	11.716	23.43	35.14	46.86	58.58	70.29	82.01	93.72	105.42	117.16	128.87	140.58	152.30	164.02	175.74	187.44	199.14	210.84
63 5	.268	.537	1.074	2.148	3.222	4.296	5.370	10.740	21.48	32.22	42.96	53.70	64.44	75.18	85.92	96.66	107.40	118.14	128.88	139.72	150.36	161.10	171.84	182.58	193.32
63 6	.244	.488	.976	1.952	2.929	3.905	4.882	9.764	19.52	29.29	39.05	48.82	58.58	68.34	78.10	87.87	97.64	107.40	117.16	126.92	136.68	146.44	156.20	165.97	175.74
63 7	.219	.439	.878	1.756	2.635	3.513	4.392	8.784	17.56	26.35	35.13	43.92	52.70	61.48	70.26	79.05	87.84	96.62	105.40	114.18	122.96	131.76	140.52	149.31	158.10
63 8	.195	.390	.780	1.561	2.342	3.123	3.904	7.808	15.61	23.42	31.23	39.04	46.84	54.65	62.46	70.27	78.08	85.88	93.68	101.49	109.30	117.12	124.92	132.73	140.54
63 9	.170	.341	.683	1.366	2.049	2.732	3.416	6.832	13.66	20.49	27.32	34.16	40.98	47.82	54.64	61.48	68.32	75.14	81.96	88.80	95.64	102.48	109.28	116.12	122.96
63 10	.146	.292	.585	1.171	1.756	2.342	2.928	5.856	11.71	17.56	23.42	29.28	35.12	40.99	46.84	52.70	58.56	64.40	70.24	76.11	81.98	87.84	93.68	99.54	105.40
63 11	.122	.244	.488	.976	1.464	1.952	2.440	4.880	9.76	14.64	19.52	24.40	29.28	34.16	39.04	43.92	48.80	53.68	58.56	63.44	68.32	73.20	78.08	82.96	87.84
63 12	.097	.195	.390	.780	1.171	1.561	1.952	3.904	7.80	11.71	15.61	19.52	23.42	27.32	31.22	35.13	39.04	42.94	46.84	50.74	54.64	58.56	62.44	66.35	70.26
63 13	.073	.146	.292	.585	.878	1.171	1.464	2.928	5.85	8.78	11.71	14.64	17.56	20.49	23.42	26.35	29.28	32.20	35.12	38.05	40.98	43.92	46.84	49.77	52.70
63 14	.048	.097	.195	.390	.585	.780	.976	1.952	3.90	5.85	7.80	9.76	11.70	13.66	15.60	17.56	19.52	21.46	23.40	25.36	27.32	29.28	31.20	33.16	35.12
63 15	.024	.048	.097	.195	.292	.390	.488	976	1.95	2.92	3.90	4.88	5.84	6.83	7.80	8.76	9.76	10.72	11.68	12.67	13.66	14.64	15.60	16.56	17.52
64 0	.000	.000	.000	.000	.000	.000	.000	000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXAMPLE.—A ship draws 23 feet 2 inches in sea water. In fresh water she was loaded to that draught with 7875 tons. How much more cargo must she take on board to be fully loaded?

Under	7000	tons	and	opposite	62	lbs.	8	oz. . 164.080 tons
"	500	"	"	"	62	"	8	" 11.720 "
"	300	"	"	"	62	"	8	" 7.032 "
"	50	"	"	"	62	"	8	" 1.172 "
"	25	"	"	"	62	"	8	" .586 "
								184.59 "

Courtesy of
ROBERT W. BOXILL
Greenock, Scotland

Speed, Distance and Time.

Frequently it is of importance to compute the exact speed from a short run. The speed being known, it is sometimes necessary to find the exact distance made in 3 or 4 minutes, and during a fog or dark night for the purpose of picking up a buoy or other small object when the speed and distance are known, it is a great convenience to have the exact number of minutes required to run the distance.

The following rules and problems will show how this can be done very quickly.

TO FIND THE SPEED.

Multiply the distance run by 60 and divide the product by the time in minutes and tenths. The result will be the speed per hour.

Example: A distance of 2'.4 is made in 7m. 36s. Find the speed.

Distance run 2'.4
Minutes in 1 hour × 60
Minutes run 7m.36 = 7m.6) 144.0 (18.95 = speed
76
680
608
720
684
360
380
20

Dist. 2'.4 .38021
Minutes in 1 hour 60m. + 1.77815
2.15836
Minutes run 7m. 36s. = 7m.6 — .88081
Speed 18'.95 = 1.27755

TO FIND THE DISTANCE.

Multiply the minutes run by the speed and divide the product by 60. The result will be the distance.

Example: At a speed of 16' a run of 12m. 30s. was made. Find the distance made.

Minutes run 12m. 30s. = 12m.5
Speed × 16'
750
125
Minutes in 1 hour 60) 200.0 (3' ⅓
180
20
60 = ⅓

Minutes run 12m. 30s. = 12m.5 1.09691
Speed 16' + 1.20412
2.30103
Minutes in 1 hour 60 — 1.77815
Distance 3' ⅓ = .52288

TO FIND THE TIME.

Multiply the distance run by 60 and divide the product by the speed. The result will be the time.

Example: The speed is 14'. The distance is 3'.8. Find the number of minutes.

Distance 3'.8
Minutes in 1 hour × 60
Speed 14') 228.0 (16m.29 = 16m. 17s.
14 60
88 17.40 = 17s.
84
40
28
120
126
6

Distance 3'.8 .57978
Minutes in 1 hour 60 + 1.77815
2.35793
Speed 14' — 1.14613
Time 16m. 17s. = 16m.29 = 1.21180

TESTIMONIALS

Brooklyn, N. Y.

H. Louderbough.

Dear Sir. — We have successfully used the New Jersey Copper Paint, and must say the trade has been very much pleased with the results. It being very fine, and its good body, has convinced us that it is the best Copper Paint in the market.

I remain yours, etc., F. COSHING & CO.

Baltimore. Md.

Mr. H. Louderbough, Jersey City, N. J.

Dear Sir.—We have been selling New Jersey Copper Paint for several seasons, and it has given satisfaction to all to whom we have sold it. Our customers speak of it in the highest terms of praise, and say it is the best they have ever used. We expect to sell a good deal of it this spring.

Yours truly, LeBROU & CO.

Speed and Revolutions.

It is often convenient to know how many revolutions are required to give a ship a certain speed. For various reasons, ships are slowed for a number of hours. Then it is usually desired that she will arrive at a certain point at some particular time, and if she runs a trifle too fast it becomes necessary to slow to steerage way, stop or stand off and on, which, in some cases, is attended with more or less danger. Therefore, it is important that the vessel be slowed to the proper speed at first. This is done by the following method: First determine the coefficient for the propeller, which is found by the formula:

$$\text{Coefficient} = \frac{\text{pitch} \times 60}{6080}$$

Example: The pitch of a propeller is 24 feet 6 inches. What is the coefficient?

Pitch 24 ft. 6 in. = 24.5
Minutes in 1 hour = × 60
Feet in 1 nautical mile 6080)1470.0(.2417
12160
25400
24320
10800
6080
47200
42560
4640

The coefficient in this case is .242 and the speed of the ship per hour is found by the formula:

Speed per hour = Revolutions per minute × coefficient.

Example: The coefficient is .242 and the revolutions 89 per minute. What is the speed per hour?

Coefficient = .242
Revolutions per minute = 89
2178
1936
21.538

In case it is necessary to reduce the speed of this ship to 12 knots, the number of revolutions per hour would be found by the formula:

$$\text{Revolutions} = \frac{\text{speed per hour desired}}{\text{coefficient.}}$$

Example: The speed desired is 12 knots per hour. The coefficient is .242. What number of revolutions are required?

.242)12·000(49.5
968
2320
2178
1420
1210
210

Then 49.5 revolutions per minute will drive the ship 12 knots per hour. However, it must be remembered that the slip must be considered in every case, and as it varies from about 5% to 20%, it can only be determined by observation. Then the wind and sea must be considered.

The slip is determined by the formula:

$$\text{Slip} = \frac{\text{dist. by obs.} \sim \text{dist. by wheel}}{\text{dist. by wheel.}}$$

Example: Distance run by wheel 363 miles and by observation 340 miles. What was the percentage of slip made?

Distance by wheel = 363 miles
Distance by obs. = 340 "
Whole slip made = 23 "
363)23.00(.063
2178
1220
1089
131

Percentage of slip made = .063 or 6 3-10%.

Practical Measurements.

TO FIND THE

Area of a triangle—multiply the base by half the altitude.

Area of a circle—multiply the square of the radius by 3.1416.

Circumference of a circle—multiply the diameter by 3.1416.

Diameter of a circle—divide the circumference by 3.1416.

Surface of a sphere—multiply the area of a great circle of the sphere by 4.

Volume of a sphere—multiply the surface by one-third of the radius.

Volume of a cask—to the head diameter add two-thirds of the difference between the head and bung diameters and multiply the area by the inside length.

Table for finding capacity in gallons and tons for water tanks.

1 Cubic foot of water = 62.50 pounds.
1 " " " " = 7.50 gallons.
1 Gallon " " = 8.33 pounds.
1 Quart " " = 2.08 "
1 Pint " " = 1.04 "
1 Gill " " = 0.26 "

Example: A tank is 10 feet in length, 5 feet in breadth, and 4 feet in depth. How many gallons of water will it hold and how much will the water weigh?

10 × 5 × 4 = 200 cubic feet
Cubic feet 200
Gallons to 1 cubic foot × 7.5
Capacity in gallons 1500.0

Cubic feet 200
Pounds to 1 cubic foot 62.5
6¼ tons =12500.0

Ans.—The tank will hold 1500 gallons of water, which will weigh 12500 pounds, or 6¼ tons.

Fouling and Marine Painting.

The degree of foulness contracted by an unprotected vessel varies with circumstances, a smooth surface will not foul as quick as a rough surface, as the rough surface presents plenty of pockets for the barnacles, worms and other marine growths to lodge in. A vessel lying at anchor will become more foul in the same length of time than one making passage. Some waters are far more troublesome than others, and in a warmer water the vessels will foul quicker, for this reason vessels in the Gulf Stream and moving with the current sometimes foul very quickly, the warmer water facilitating the insect growth.

Experience has shown that the amount of fouling is greater in the tropics than in higher latitudes, and during summer and early fall than at any other time of the year. The port that has the most unenviable reputation in this respect is Surabaya, and it is stated that vessels lying there for a week at any period of the year will become foul, though covered with the best antifouling paint ever made. Other ports in Java are of like evil repute, and ships in the ports of the Malabar Coast, and on the Madras Coast, and in Ceylon, foul very readily during eight months of the year. Kurrachee and Bombay are also bad fouling ports during the same season. The surest and safest protection is paint; some lines, that run through bad waters, find it advantageous to dock and paint three or four times a year, as the amount spent in docking and painting will be saved in coal and time.

Marine painting upon the bottoms of vessels, both wooden and iron, has attracted much attention, and in painting problems it has been the most thought about and experimented upon. All kinds of paint compositions have been produced, and out of the many only a very few have met with any pronounced effect in solving the difficulty.

It is a great undertaking to produce a coating of paint over a given surface submerged and partly submerged in salt water under trying conditions, to make this thin coating so poisonous that it will for months resist the fouling tendency so common in salt water, and, upon wooden bottoms, stop the ravages of the teredo worm.

Even in this hard problem comes the usual request for something cheap, and that, too, has to be met by the manufacturer, and, if quality is to be considered, he cannot compete with these cheap productions.

Competition for several years past in Marine Painting has been very sharp, but the standard paints of high grade hold their trade from the fact that the cheap paints offered lack the qualities so essentially necessary, and the varied experiences of the vessel-owner and mariner holds to the fact that the best they can get is the cheapest in the long run.

Disturbances of the Sea.

Wind is air in motion, and sea waves are the direct effect of the friction caused by the wind passing over the water, and calms are due to the absence of such friction.

The terms wave and swell are not infrequently confounded by inexperienced persons; but seldom or never by a seaman. However, a sea can be formed on a very heavy swell, and at the same time be distinct from the swell. The term used in describing this condition would be—a sea and a swell; but if the velocity of the wind should remain constant or increase, the swell will finally become a part of the sea.

The theory advanced by some that waves have a progressive motion, is erroneous. In the most violent gales, a surface drift is experienced and rarely exceeds one mile per hour, except in rotary storms, where this drift sometimes reaches to about five miles per hour; but the body of water which extends above the surface remains in the same position.

An interesting experiment may be made to prove this by throwing overboard a piece of wood when a ship is anchored in an open roadstead during a heavy sea. The sea will appear to run by the ship very rapidly, which is evidently responsible for the term—a sea is running, and for the theory that waves travel. However, the piece of wood will drift no faster than the current, which is also a result of the friction of wind passing over the water.

A short, chop, cross or lumpy sea does not have the appearance of running by the ship, as one sea apparently rises from the trough of another.

It is a common practice among navigators to allow for a heave of the sea, which is the effect of the sea breaking on or very near the ship.

A very heavy swell is often experienced hundreds of miles from the centre of disturbance, and is nothing more than the subsiding sea seeking its proper level. If increasing, it indicates coming wind, usually strong; but if decreasing, the disturbance is not approaching. Sometimes a swell is due to some volcanic disturbance, or to the luna-tidal wave. Beyond any doubt, the former is more or less responsible for the long, easy, almost constant swell of the Pacific.

The North Atlantic seems to be quite free from volcanic disturbances, from the fact that during the summer months it is often smooth as a mill pond.

Frequently from a change of wind, a cross sea will be experienced, and is sometimes described as lumpy; but so long as the wind continues steady, the new sea will cut down the old and become more regular; but if the wind should be frequently changing, the sea will become more lumpy.

The greatest height of waves so far recorded is forty-two feet from the trough to the crest, and it uncommon to seamen.

Anchors, chains and hawsers required for sail and steam vessels. The weight of anchors does not include the stock, which should be of either iron or wood and in proper proportion to the anchor.

SAIL VESSELS.					STEAMERS.			
Tonnage of Vessel.	Anchors without stock.	Size of Stud Chain Cable.	Length of Stud Chain Cable.	Size of Hawser, 90 fathoms length	Anchors without stock.	Size of Stud Chain Cable.	Length of Stud Chain Cable.	Size of Hawser, 90 fathoms length.
Tons	Pounds	Inches	Fathoms	Inches	Pounds	Inches	Fathoms	Inches
75	600	13-16	90	4	294	11-16	90	3½
100	700	⅞	105	4¼	392	11-16	105	3½
125	800	15-16	105	4½	420	13-16	120	3½
150	900	1	120	4¾	504	13-16	120	4
175	1000	1 1-16	120	5	588	14-16	120	4
200	1100	1⅛	120	5¼	672	14-16	120	4
250	1300	1 3-16	135	5½	840	15-16	120	5
300	1450	1¼	135	5¾	1008	1	120	5
350	1625	1 5-16	150	6	1176	1 1-16	120	5½
400	1850	1 5-16	150	6½	1344	1 2-16	135	6
450	1900	1⅜	165	7	1512	1 3-16	135	6½
500	2125	1 7-16	165	7½	1680	1 4-16	150	7
600	2450	1½	180	8	1848	1 5-16	150	7
700	2800	1 9-16	180	8½	2016	1 6-16	165	8
800	3125	1⅝	180	9	2184	1 7-16	165	8
900	3350	111-16	180	9	2380	1 8-16	180	9
1000	3575	1¾	180	9½	2600	1 9-16	180	9
1200	3800	1⅞	180	10	2850	110-16	180	9½
1400	4000	115-16	180	10	3100	111-16	180	10
1600	4250	2	180	10½	3350	112-16	180	10½
1800	4500	2	180	11	3600	113-16	180	11
2000	4700	2 1-16	180	11	3800	114-16	180	11
2500	5000	2⅛	180	11½	4250	2	270	12
3000	5400	2 3-16	180	12	4400	2 1-16	270	12
3500	5800	2¼	180	12	4600	2 2-16	270	12

In these tables will be found the safe load for manila and iron-wire ropes and chains. The load is given in tons of 2,000 pounds.

Wire Rope.		Manila Rope.		Chain.	
Size.	Safe Load.	Size.	Safe Load.	Size.	Safe Load.
1 in.	0.3	1 in.	0.1	¼ in.	0 4
1½ "	0.6	1½ "	0.2	⅜ "	1.0
1¾ "	0.9	2 "	0.4	½ "	1.8
2 "	1.2	2½ "	0.6	⅝ "	2.8
2¼ "	1.5	3 "	0.9	¾ "	4.0
2½ "	1.9	3½ "	1.2	⅞ "	5.4
2¾ "	2.2	4 "	1.6	1 "	7.1
3 "	2.7	4½ "	2.0		
3¼ "	3.2	5 "	2.5		
3½ "	3.7	5½ "	3.0		
3¾ "	4.2	6 "	3.6		
4 "	4.8				

Testimonials.

Pensacola, Fla.,
Mr. Harry Louderbough, Jersey City.

Dear Sir.—We are continually told by our customers who have used the New Jersey Copper Paint, that they find it gives a smoother bottom than other Paints, and gives universal satisfaction every other way. This may be "the same old tale so often told," and not be new to you, still we feel like complimenting you and the New Jersey Copper Paint, and think it classes with the best; and shall shortly have the pleasure of sending you order for the spring and summer supply. Yours, &c.,

McKENZIE, OERTING & CO.

Note the positive expressions of Quality in the following Testimonials. This verdict is from the users of Copper Paint, that

NEW JERSEY COPPER PAINT

LEADS THEM ALL.

Savannah, Ga.,
Mr. H. Louderbough.

Dear Sir.—I have, at my Marine Railway, used considerable of your New Jersey Copper Paint, and I believe it to be the best Copper Paint on the market. H. F. WILLINK.

St. Augustine, Florida,
Mr. H. Louderbough.

Dear Sir.—I have sold your New Jersey Copper Paint, and I am fully satisfied of its good qualities, and, being a practical painter, I know a good thing when I see it; it applies easily, freely entering the wood, thereby poisoning it; and its coating is smooth, making a good sailing bottom, and, as an anti-fouler, it is the best I have ever seen. I am yours, &c.,
W. MELFORD INGRAHAM.

Norfolk, Va.,
Mr. H. Louderbough.

Dear Sir.—I have used, at my Railways at Berkley, Va., painting a large number of vessels with your New Jersey Copper Paint, and I am free to confess it has given splendid satisfaction among my many customers, proving itself to be a very smooth Paint and a great anti-fouler.
I remain, yours, &c., CHAS. J. COLONNA.

Baltimore, Maryland,
Mr. H. Louderbough.

Dear Sir.—I have for years sold about every Copper Paint offered in our market, and, after having this experience, to-day my sales are confined to some three leading Paints, and one of them is your New Jersey Copper Paint, which I believe to be one of the best Paints in this market.
I am, respectfully yours, &c.,
ANTON RASMUSSEN.

Tompkins Cove, N. Y.,
Mr. H. Louderbough.

Dear Sir.—During the past season I have applied considerable of your Copper Paint, and, after having used all other brands, I must say I am convinced of its very superior qualities over all others, it being so easy to apply, working nicely under the brush, being very fine and smooth, making a splendid sailing bottom. I remain, yours, &c.,
H. J. RODERMOND.

Portland, Me.,
Mr. Harry Louderbough.

Dear Sir.—We sold your Copper Paint in considerable quantities in 1890. So far as we have been able to ascertain, the results were in every case satisfactory. We have yet to receive the first complaint, a fact which is quite unusual in the sale of a new article. Respectfully yours,
BURGESS, FOBES & CO.

Brooklyn,
Mr. H. Louderbough.

Dear Sir.—We have at our Dry Dock, used some of your New Jersey Copper Paint, and it has given us good satisfaction, being very smooth, having no coarse or rough copper in the bottom of the can, all mixing with the Paint. I remain, yours, &c.,
GEORGE DAVIDSON,
Agent Brooklyn Water Front W. & D. Dock Co.

Law of Storms.

It is a well known fact that all great storms have a rotary and a progressive motion and in many instances cover an area of several hundred miles in diameter. As soon as it becomes known that a ship is in one of these storms, it is important that the bearing of the center and the direction of the storm track should be determined as soon as possible, that the ship's position in the storm may be known.

In north latitude face the wind and the storm center will bear not less than eight, and not more than ten points to the right. Now that the bearing of the center is known, the direction of the storm track can be determined by noting the change of wind.

If the ship is directly on, and in front of the storm track, the wind will not change, and the barometer will rapidly fall, and at the same time the wind and sea will rapidly increase in violence. In that case, run before the wind; note the course, and keep it until the barometer rises, and wind and sea moderate sufficiently to free the ship from danger. If the ship cannot run dead before it, take the wind one or two points on the starboard quarter; but be careful not to take it on the port quarter.

If the wind is southeast, the storm center will bear about S. W. by W.

Suppose the wind changes to S. S. E., which would be to the right, that would prove conclusively that the ship is in the right-hand semi-circle, and that the storm is moving in a northwesterly direction, and the ship should be hove-to on the starboard tack, or run with wind two points on starboard quarter.

On the other hand, suppose the wind is N. E. the storm center will bear about S. E. by S., and the wind changes to N. N. E., which would be to the left, and would show that the ship is in the left hand semi-circle. To better the weather, take the wind two points on the starboard quarter, note the course and keep it. If the ship cannot run, heave-to on the port tack.

It will be noticed that the ship in the left semi-circle lies with her head towards the center when hove-to; but that does not indicate danger, because the ship cannot forereach any. However, she must lie on the coming up tack in all cases, and, if hove-to on an improper tack, she would break off at every change of wind, deaden her way, ship heavy seas, lose sails and probably her masts.

Very frequently a ship can derive considerable advantage in the way of fair wind from a hurricane, if the law of storms is properly understood. As an example: suppose a ship is in the right hand semi-circle with the wind S. W., the storm center bearing about N. W. by W., and the storm track is N. E., and about the same as the ship's course. In such a position, the ship can get out of the storm by either heaving-to on the starboard tack or running with the wind on the starboard quarter. To use the wind, if the wind and sea are heavier than desired, haul the ship more to the eastward, 'till the barometer rises very little, and the wind and sea moderate as desired; then resume the course. On the other hand, if the wind should moderate more than is necessary, haul the ship more to the northward, 'till the wind increases sufficiently; then resume the course. Some care must be exercised in this maneuver to keep the ship as close to the center as safety will permit, or the storm will pass her before she has received a reasonable benefit from it. Under ordinary circumstances a ship should stay with the storm about three days. In the above case she will be out of the storm when the wind changes to W., and find herself becalmed in a short time.

When using a storm in this manner, the bearing of the center must be kept constantly located and a sharp watch be kept on the storm track, as it may change to the eastward, and in case it does, immediate action must be taken to increase the distance from the center. In these storms, a current of three to five knots can be relied on, running with the wind.

In the southern hemisphere the rotary motion of these storms is contrary to those of the northern hemisphere, and the maneuvers would, of course, be contrary to those of the northern hemisphere. However, the progressive motion is from the equator towards the pole in both hemispheres. For hurricane indications see the following notes.

About twenty-four hours, and sometimes two or three days before a hurricane, the barometer will stand somewhat above the normal, with unusually fine, clear weather, with calm or very light variable winds. At such times the atmosphere is unusually clear, and objects are more distinctly visible than ordinarily. The next indication will be a long, quite heavy swell and then the barometer will begin to fall. The air will become more moist, and heavy, black, rolled and ragged clouds will rise in the direction from which the swell came. The barometer by this time will have fallen considerable, and its reading should be frequently recorded, and also the direction of the wind at the same time and at every shift. The clouds will soon nearly or wholly cover the sky and the ship will be on the edge of the violence of the storm, and, with a little skillful handling, she can be brought out safely and the fury and violence of the storm wholly avoided if the instructions given above are followed.

AMERICAN

"Iron Crown" Paint

FOR IRON AND STEEL VESSELS' BOTTOMS.

AN OLD AND RELIABLE PAINT

FOR FIRST AND SECOND COATS.

No. 1

PRIMING COAT.

AN IRON PRESERV-ATIVE.

DRIES QUICKLY.

No. 2

FINISHING and ANTI-FOULING PAINT.

TESTIMONIALS OF MERIT

After Years of Trial Demonstrate Its Effectiveness.

New Jersey Paint Works,

HARRY LOUDERBOUGH, Inc.

Jersey City, N. J., U. S. A.

Successor to R. F. Seaman

The Barometer.

A rapid rise indicates unsettled weather.

A gradual rise indicates settled weather.

A rise with dry air and cold increasing in summer indicates wind from the northward. If rain has fallen, better weather may be expected.

A rise with a moist air and a low temperature indicates wind and rain from the northward.

A rise with southerly wind indicates fine weather.

A steady barometer and temperature with dry air indicates a continuance of fine weather.

A rapid fall indicates stormy weather.

A rapid fall with westerly wind indicates stormy weather from the northward.

A fall with northerly wind indicates a storm with rain and hail in summer, and snow in winter.

A fall with increased moisture in the air and increasing heat, indicates southerly wind and rain.

A fall with very calm and warm weather indicates rain and squally weather.

The barometer rises for northerly wind, including from N. W. by N. to the eastward, for dry or less wet weather, less wind, or for more than one of these changes, except on some occasions, when rain, hail or snow comes from the northward with strong wind.

The barometer falls for southerly wind, including from S. E. by S. to the westward, for wet weather, stronger wind or one or more of these changes, except on some occasions when moderate wind with rain or snow comes from the northward.

A falling barometer with north wind indicates rain and wind in summer, and snow in the spring.

A sudden fall with the wind west is an indication of very bad weather from the north or northwest.

A steady fall with the wind east indicates that the wind will change to south, or be followed with rain or snow.

A fall of the barometer with a south wind is followed by more or less rain.

If the barometer falls, and after the storm, remains steady and does not rise, bad weather may be expected without a change of wind. On the other hand, if the barometer rises, the wind may change.

The words fair, change, etc., on the barometer should not be regarded, as they have no value.

To obtain advantageous results from the use of a barometer, its reading should be recorded at regular intervals. At the same time a record of the temperature and the direction of the wind should be made. During very bad or unsettled weather, and at times when such weather is expected, the observations should be as frequent as may be convenient.

During fine or settled weather, the barometer will stand highest at 10h A. M. and 10h P. M., and lowest at 4h A. M. and 4h P. M. This oscillation amounts to about .05 of an inch. It then follows that if the reading of the instrument is the same at 10h in the morning as it was some two or three hours earlier, it is equivalent to a fall of .05 of an inch. The other hours of high and low must be considered when the observations are of any importance.

Most barometers are not exactly correct, and before the instrument is put to practical use its error should be known, and can be obtained at any branch Hydrographic office without cost.

With the general rules given above for using the barometer in foretelling the weather, the following weather indications must be considered, as they not infrequently give warning of the coming weather earlier than the barometer.

A clear red sunset with a red sky is an indication of fine weather, and probably westerly winds.

A red sunrise with a red sky is an indication of bad weather with east or northeasterly winds. A pale sky and sunset in a bank of clouds is an indication of easterly wind. A clear yellow sunset indicates strong breeze. A clear pale or gray sky at sunrise indicates fine weather. Soft, downy, delicate clouds and a light blue sky indicate fine weather with light variable winds. A dark and gloomy blue sky is an indication of strong wind, and if the clouds are hard and ragged looking, strong gales may be expected.

A small, white, fleecy cloud often hangs over a small island or reef.

When keeping a record of the barometer readings, it is necessary that they be exact for the nearest hundredth of an inch. The common practice of reading the instrument to tenths only is not sufficient. Figure one shows an aneroid barometer face from 29 inches to 31 inches. The barometer hand cuts 30.43 inches and shows that every tenth of an inch is divided into five parts of .02 of an inch each. The dumb hand cuts 29.29 inches. By recording the readings of the instrument in this way, it is at once noticed by referring to the last reading, if it is rising or falling, which is frequently very important.

The mercurial barometer has a scale graduated to tenths of an inch and by the vernier it is read to .01 of an inch. Figure two shows a mercurial barometer scale and vernier reading

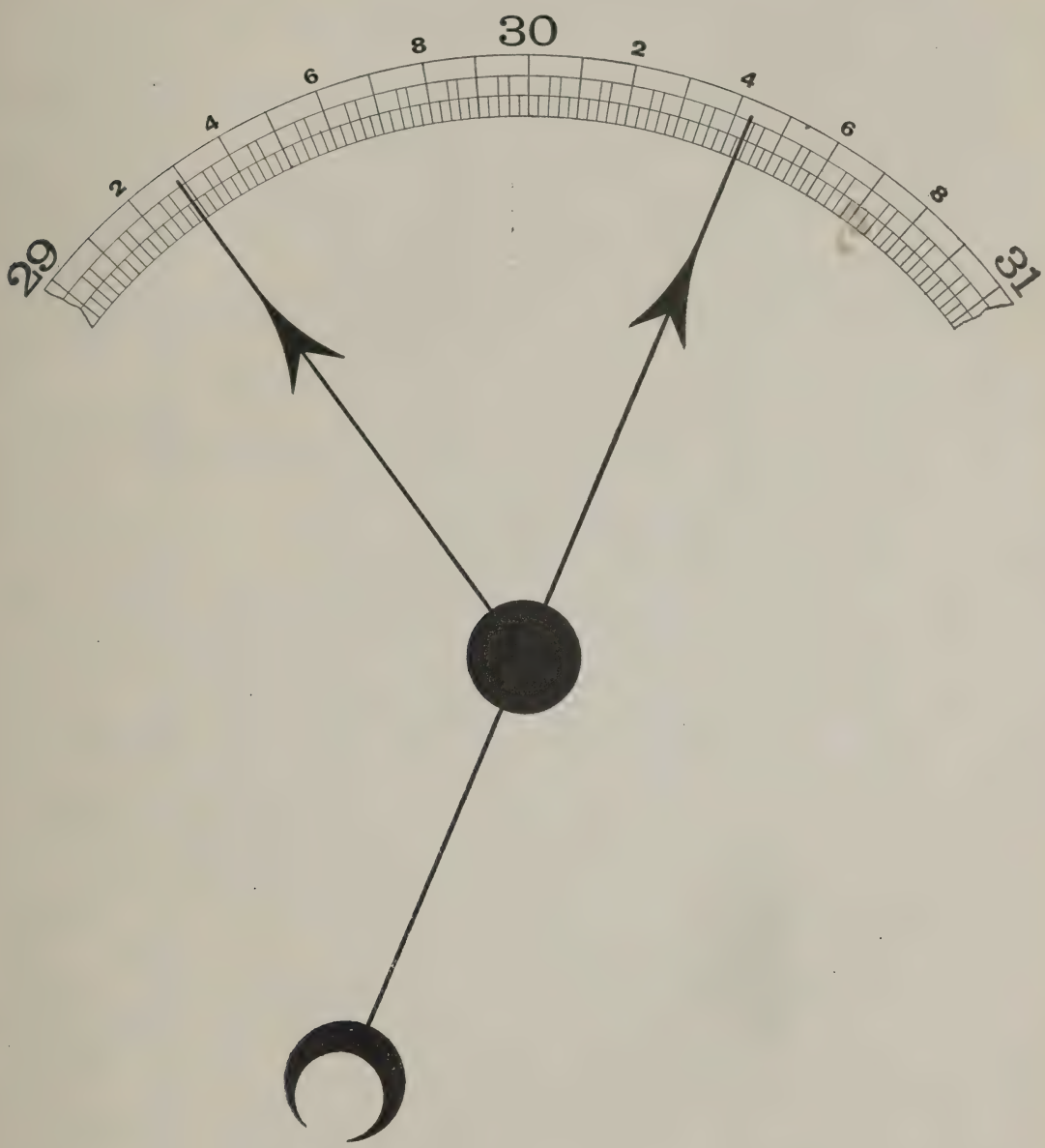


FIG. 1

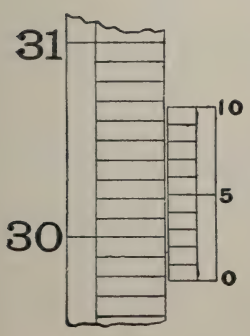


Fig. 2.

29.77 inches. The zero on the vernier is between 29.70 inches and 29.80 inches. On the vernier 7 is the first division which cuts and 29.70 on the scale and .07 on the vernier make the reading 29.77 inches.

Figure three shows a reading of 28.32 inches The zero on the vernier is between 28.30 inches and 28.40 inches. On the venier 2 is the first division which cuts, and 28.30 on the scale and .02 on the venier make the reading 28.32 inches.

A thermometer is attached to each merecurial barometer to obtain the temperature of the mer-

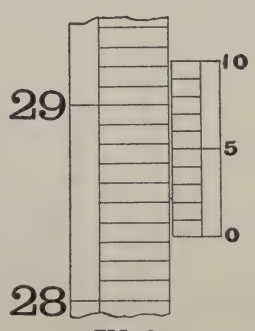


FIG. 3

cury, and to the reading of the barometer a correction is applied corresponding to the temperature, which, by inspection of the following table, will be found to be of some importance.

Temperature.	Correction Inch	Temperature.	Correction Inch	Temperature.	Correction Inch	Temperature.	Correction Inch
20° F.	+ .02	40° F.	— .03	60° F.	— .09	80° F.	— .14
22	+ .02	42	— .04	62	— .09	82	— .14
24	+ .01	44	— .04	64	— .09	84	— .15
26	+ .01	46	— .05	66	— .10	86	— .15
28	.00	48	— .05	68	— .10	88	— .16
30	.00	50	— .06	70	— .11	90	— .16
32	— .01	52	— .06	72	— .12	92	— .17
34	— .02	54	— .07	74	— .12	94	— .17
36	— .02	56	— .07	76	— .13	96	— .18
38	— .03	58	— .08	78	— .13	98	— .18

No correction for temperature is applied to readings of the aneroid barometer.

This table is from page 23, Bowditch Epitome, and the signs prefixed to the correction indicate how it is to be applied. Plus (+) meaning add. Minus (—) meaning subtract.

TESTIMONIALS.

Brooklyn, N. Y.,

Mr. H. Louderbough.

Dear Sir.—At our three Dry Docks I have for several years used your "New Jersey" Copper Paint, and it is with a great deal of pleasure that I give it our endorsement, for all the good qualities it possesses; it being smoothly ground, it is easy to apply, producing a good sailing as well as a good Anti-Fouling surface. Yours truly,

WM. GOKEY.

Boston, Mass.,

Mr. Harry Louderbough.

Dear Sir.—At our store we have jobbed and retailed your "New Jersey" brands of Marine Paints, and find that our yachtsmen look upon them with great favor, for their good qualities have become pretty well known. As Anti-Fouling Paints, we believe them to be without an equal.

Yours truly, I. H. WILEY & CO.

San Francisco, Cal.,

Mr. H. Louderbough.

Dear Sir.—We have been using your New Jersey Copper Paint on the bottoms of our Vessels for several years. The fishing business is trying on Copper Paint, as the vessels lie at anchor on the grounds and are particularly liable to become fouled. Your New Jersey Copper Paint has given us entire satisfaction. Yours truly,

THE McCOLLAM FISHING & TRADING CO.

Tottenville, N. Y.,

Mr. H. Louderbough.

Dear Sir.—For some ten years we have used, at our Railways and construction plant, your "New Jersey" Copper Paint, and your Yacht Specialties, and have always found them reliable Paints, giving complete satisfaction to our customers and ourselves.

Yours truly, A. C. BROWN & SONS.

Hoboken, N. J.,

Mr. Harry Louderbough.

Dear Sir.—After many years' use of your "New Jersey" Copper Paint, and "New Jersey" Seam Paint, they have proven to be all that one can expect of them, and we can cheerfully give them a good endorsement, as they are popular, as well with our customers as they are with us.

Yours truly, JOHN McCARTHY & BRO.

New York,

Harry Louderbough.

Dear Sir.—In applying your Wetterstedt Copper Paint, we found it to be all you claimed for it. Its smoothness makes it easy to apply; producing a splendid bottom offering no resistance.

Yours truly,

JAS. TREGARTHEN SON & CO.

New York,

Harry Louderbough.

Dear Sir.—Your "New Jersey" Copper Paint has always been a favorite with us. After a test of eleven years it has proven to be a reliable Anti-Fouling Paint. Our customers using it once are very apt to use it again. Yours truly,

JAMES SHEWAN & SONS.

Galveston, Texas,

Mr. H. Louderbough.

Dear Sir.—Our Southern waters are very troublesome to our vessels, as they promote the formation of barnacles and vegetation, and your production of "New Jersey" Copper Paint has proven itself to be all that you claim for it, doing its work as an Anti-Fouling Paint very successfully. Our sales of your Perfect Ship Black, in connection with your Copper Paint meets with the very strong endorsement of our friends and ourselves. Yours truly,

T. L. CROSS & CO.

Perth Amboy, N. J.,

Mr. H. Louderbough.

Dear Sir.—The use of New Jersey Copper Paint at our Dry Dock and Railway has proven itself to be a very effective Paint, easy to apply, and being very fine, it freely enters the wood and produces a good sailing bottom. We consider it to be the best Copper Paint in the market. Respectfully,

PERTH AMBOY DRY DOCK CO.

Thomaston, Me.,

Mr. H. Louderbough.

Dear Sir.—Our repeated orders for your New Jersey Copper Paint must convince you of our favorable opinion of your Copper Paint; in its use our painters all speak well of it. It produces a splended sailing bottom on account of its fineness.

We remain, truly yours,

DUNN & ELLIOT.

Halifax, N. S., Canada,

Mr. Harry Louderbough.

Dear Sir.—As agents for your Copper Paint, at this point, it is pleasing to know that after its introduction was started our business has grown to such an extent, that "New Jersey" Copper Paint is now much used in the face of older established paints that once controlled our market. Yours truly,

CROWELL BROS.

North Sydney, Cape Breton,

Mr. Harry Louderbough.

Dear Sir. The best protection that one can apply to the bottom of a vessel is a reliable Copper Paint. When quality is being considered, our patrons give your "New Jersey" Copper Paint the preference, for its well known and well earned reputation places it in the front with all comparisons.

Yours tuly,

FORBES & ARCHIBALD.

San Francisco, Cal.,

H. Louderbough, Esq.

Dear Sir.—Having given the New Jersey Copper Paint a thorough test, I do not hesitate to say it is the best and most serviceable I have ever used, it having stood for seven months on a voyage from Port Blakeley to Valparaiso and other South American ports, and to-day is nearly as clean as when put on.

For several days I was becalmed on the Equator, and for twenty days was loading at Valparaiso.

In the matter of economy, it can be put on very easily, and covers more bottom than any other Copper Paint I have ever used.

H. R. JACOBSON,

Master Schooner H. C. Wright.

THE BEST IS THE CHEAPEST

"NEW JERSEY"

YACHT (SEMI-FLAT FINISH) WHITE

A PURE WHITE MIXED PAINT SPECIALLY FOR YACHTS

AMERICAN INSTITUTE MEDAL

MANUFACTURED FROM
BEST PIGMENTS

FINELY GROUND
MAKING A SMOOTH SURFACE

IF TOO THICK, THIN WITH
PURE SPIRITS TURPENTINE

NATIONAL EXPORT EXPOSITION MEDAL

NEW JERSEY PAINT WORKS,

JERSEY CITY, N.J. U.S.A.

HARRY LOUDERBOUGH INC.

Use of Oil for Modifying the Sea.

In using oil for this purpose, the one great difficulty is to have the oil reach the water far enough to windward to give the ship the benefit of its effect. This may be effected by attaching an oil bag to a drag, in case the ship is hove-to with that contrivance.

Running before the wind, oil bags should be towed from both catheads. The tow-line should be of such length as may be necessary to keep the bags in the water.

Hove-to with or without a drag, an oil bag on the weather bow, one about midships and one on the quarter will have a modifying effect.

Mineral oils are of little or no use for this purpose. Animal or vegetable oils are satisfactory. In cold weather, the effect of oil on rough water is considerably less than in warm weather, for the simple reason that the oil thickens and will not spread freely. The result of experiments covering a period of several years seems to indicate that lard oil gives the most satisfactory results.

Oil bags should be made of canvas, and of sufficient size to hold oakum enough to absorb from one to two gallons of oil, and there should be holes in the bag of sufficient size to permit the oil to leak out, and to admit the water in quantities large enough to act as an agent in making the leakage uniform.

Many navigators have condemned oil bags for the simple reason that the oil could not escape; the holes being small, having been made with a sail needle. The holes should be at least one-quarter of an inch in diameter.

Management of Small Boats Landing Through a Surf.

Boats employed where it is frequently necessary to beach them when the sea is breaking heavy, are specially constructed for the purpose, and sometimes to meet conditions peculiar to the particular locality, and manned by crews who are not only expert surfmen, but have a thorough knowledge of the best landing places, dangers and other local conditions. For them, landing through a surf is a matter attended with little or no difficulty.

Ships' boats are generally of the keel type and a large percentage of them have square sterns. To safely land such boats through a heavy surf, is not only very difficult, but dangerous, and should never be attempted unless absolutely necessary.

Along most beaches there are many sunken wrecks, and to come in contact with such obstructions in a small boat, during a heavy sea. would most likely result in the loss of all hands. Soundings as given on a chart very close to the beach cannot be relied on, as frequently a shore line is moved in or off shore during violent storms and often cause small shoals, over which a small boat cannot pass during heavy sea.

When making for a beach during a heavy surf, if it is impossible for those in the boat to select the place most advantageous for landing, but one on the beach can at a glance do so. Therefore keep a sharp lookout for people on the beach, and obtain their advice if possible and carefully follow it.

A boat cannot be landed through a surf under sail, and all sail should be taken in before entering broken water.

A boat cannot be handled in a heavy sea or broken water with a rudder, and it must never be attempted. To steer the boat, a long oar must be used and the becket must be of good material. An oar lock cannot be used in place of a becket.

With a double end boat, it is best to pull in to the beach head on, taking care not to allow her to broach-to and that every sea breaks either ahead or astern of her. This may be effected by either pulling the boat ahead or checking her way, according as her position may require. When the boat goes up on the beach on the last sea, all hands should jump out and hold on to her by the gunwales to prevent her being carried off the beach in the undertow. In some cases it may be advisable to use a small anchor to assist in holding the boat on the beach.

With a square stern boat the method of landing is about the same as for a double end boat, except that before entering the broken water she must be brought head to the sea and landed stern first.

While the value of the oil in landing during a heavy surf is not great, its use is not to be discouraged altogether, as it will certainly diminish the danger rather than increase it.

Explanation of Storm Warnings.

Warnings of the approach of windstorms will be published by the display of flags by day and lanterns by night, in connection with the bulletins posted and the reports furnished to newspapers, mariners, and others interested.

The warnings adopted by the U. S. Weather Bureau for announcing the approach of windstorms are as follows:

The **Storm Warning** (a red flag, eight feet square, with black center, three feet square) indicates that a storm of marked violence is expected.

The **Red Pennant** (eight feet hoist and fifteen feet fly) displayed with the flags, indicates easterly winds, that is, from the northeast to south, inclusive, and that the storm center is approaching.

The **White Pennant** (eight feet hoist and fifteen feet fly) displayed with the flags, indicates westerly winds, that is, from north to southwest, inclusive, and that the storm center has passed.

When the **Red Pennant** is hoisted above the Storm Warning, winds are expected from the *northeast quadrant;* when below, from the *southeast quadrant.*

When the **White Pennant** is hoisted above the Storm Warning, winds are expected from the *northwest quadrant;* when below, from the *southwest quadrant.*

Night Storm Warnings.—By night a *red light* will indicate *easterly winds;* a *white* above a *red light* will indicate *westerly winds.*

The **Information Warnings** have been discontinued at all storm-warning display stations, and such advices as were previously given in information orders will be furnished hereafter in advisory messages.

The **Hurricane Warning** (two storm-warning flags, red with black centers, displayed one above the other) indicates the expected approach of a tropical hurricane or of an extremely severe and dangerous storm.

No night Hurricane Warnings are displayed.

NOTE.—The attention of captains is invited to the fact that at most regular Weather Bureau stations, by application to the Weather Bureau official, they may have their barometers compared. This service will always be rendered without compensation.

Perth Amboy, N. J.,

Mr. Harry Louderbough.

Dear Sir.—A proof of a good thing is in its use, and we feel that we can give your New Jersey Marine Paints a good endorsement; having been shipmates with them for many years, and large users of your Marine Paints, gives us confidence in giving them our hearty endorsement. Yours truly,

RARITAN DRY DOCK CO.

Bagdad, Fla.,

Mr. Harry Louderbough.

Dear Sir.—For eleven years I have been in touch with your "New Jersey" Copper Paint, using no others, and I desire to express to you my entire satisfaction; it has proved itself to be the most reliable ever used, showing clean even in the bad fouling waters of Florida.

Yours truly, GEO. BRUCE.

Boston,

Harry Louderbough, Esq., Prop. New Jersey Paint Works, Jersey City. N. J.

Dear Sir.—We beg to state that the New Jersey Copper Paint is giving our customers splendid satisfaction. We are having a steady trade for this article, which is on the increase. This speaks for itself.

Yours truly, DeLONG & SEAMAN.

Norfolk, Va.,

Mr. Harry Louderbough.

Dear Sir.—The demand for "New Jersey" Copper Paint is so very great in this market that we carry no other kind, and all this Paint's success has been obtained in a few years against the older brands which, at one time, had the control of this market.

Yours truly, JENKINS PAINT & OIL CO.

Baltimore,

Mr. H. Louderbough.

Dear Sir.—I have sold and handled your New Jersey Copper Paint for some eleven years, and I can cheerfully recommend it, for it has proven itself to be the best Copper Paint I have ever sold; it is smooth, making a fine sailing bottom, and keeps remarkably clean, even in the bad fouling waters of our bay. Yours respectfully,

J. H. HOLTHAUS, JR.

Jersey City, N. J.,

Mr. Harry Louderbough.

Dear Sir.—We have used at our Dry Dock your "New Jersey" Perfect Ship Black, and find it far superior to any other Paint we have ever used. It is the blackest black Paint made, dries quickly, and does not grow gray or dull as many others do.

Yours truly, BURT & MITCHELL CO.

Mathematical Signs.

+ PLUS. The sign of addition; as $2° 50' + 17' = 3° 07'$. When prefixed to a number thus, $+ 16' 05''$, it indicates that the quantity is positive, and when placed to the right of a number, it indicates that some figures have been dropped, as 3.14159+. *See* π.

— MINUS. The sign of subtraction; as $3° 10' - 24' = 2° 46'$. When prefixed to a number thus, $- 57' 17''$, it indicates that the quantity is negative.

= EQUAL TO. The sign of equality; as $67° 45' 30'' = 4h\ 31m\ 02s$.

× MULTIPLY. The sign of multiplication; as $43° 50' \times 2 = 87° 40'$.

• DECIMAL POINT. The sign indicating by its position the value of a number; as

125. is one hundred and twenty-five.
12.5 is twelve and one half, or $12\frac{5}{10}$.
1.25 is one and one quarter, or $1\frac{25}{100}$.
.125 is one eighth, or $\frac{125}{1000}$; all of which are expressed decimally.

÷ DIVIDE. The sign of division; as $17° 10' \div 2 = 8° 35'$, and is more frequently written thus, $\frac{17° 10'}{2} = 8° 35'$.

ϖ DIFFERENCE. This sign indicates that the difference of the two numbers between which it is placed, is to be considered; as $\overline{30° 10' \varpi 28° 27'} \times 2 = 3° 26'$. *See vinculum.*

: :: : PROPORTION. As 40m : 60m :: 8′ : 12′; or, as 40m is to 60m so is 8′ to 12′; but more frequently written thus $\frac{60m \times 8'}{40m} = 12'$.

^{2} TO BE SQUARED; as $7^2 = 49$, which is $7 \times 7 = 49$.

^{3} TO BE CUBED; as $6^3 = 216$, which is $6 \times 6 = 36$ and $36 \times 6 = 216$.

$\sqrt{\ }$ RADICAL SIGN. This sign when prefixed to a number indicates that its square root is to be taken; as $\sqrt{36} = 6$.

$\sqrt[3]{\ }$ THIS sign when prefixed to a number indicates that its cube root is to be taken; $\sqrt[3]{216} = 6$.

$\overline{\ \ }$ VINCULUM. This sign indicates that the quantities under it are to be considered together or collectively; as $\overline{3 + 5} \times 4 = 32$. Without the vinculum this equation would be $3 + 5 \times 4 = 23$.

( ) BRACKETS or PARENTHESES. Are used the same as the vinculum; as $(3 + 5) \times 4 = 32$.

π THE number 3.141592653589793+; The ratio of the circumference of a circle.

n ANY. Meaning any number or quantity.

DECIMALS.

Decimals are fractions which have some power of ten for their denominators, and are written without the denominator, which is understood. The value of a fraction expressed decimally is determined by its number figures, to the left of which a point (.) is always placed.

The fractional parts of a dollar are expressed decimally and offer the student a valuable aid.

10 mills = 1 cent, 10 cents = 1 dime, 10 dimes = 1 dollar, or 1 dollar = 10 dimes, 10 dimes = 100 cents, 100 cents = 1000 mills.

One dime is $\frac{1}{10}$ or $\frac{10}{100}$ of a dollar, and as a decimal is written .1 or .10, which shows that ciphers have no value when placed on the right hand side of a decimal, as 1 dime and ten cents are equal. From the above description of a dollar, it is clear that it contains 1000 mills. Then, as one cent contains 10 mills, it must be $\frac{10}{1000}$ of a dollar, and it as a decimal is written .010, which shows that ciphers placed on the left hand side of a decimal, alter its value.

Just as the dollar is divided into 10, 100 or 1000 parts, so is anything else when necessary.

ADDITION.

Decimals are added the same as whole numbers, except that the straight line is on the left hand side, and the decimal point is placed in the sum directly under the position it occupies in the quantities added.

Examples: Find the sum \$1.30, .17 and .08. Also 8.42 miles, 1.30 miles and .08 miles.

Dollars.
1.30
.17
.08
1.55

Ans. one dollar and fifty-five cents.

Miles.
8.42
1.30
.08
9.80

Ans. nine miles and eighty hundredths.

SUBTRACTION.

Place the numbers, one under the other, having regard for the decimal point as in addition, and subtract the lesser quantity from the greater.

Example: From $9.80, subtract $1.55. From 19.6 fathoms, subtract 8.7 fathoms.

Dollars.	Fathoms.
9.80	19.6
1.55	8.7
8.25	10.9

Ans. 8 dollars and 25 cents. Ans. 10 fathoms and nine tenths.

MULTIPLICATION.

Multiplication of decimals is the same as in the case of whole numbers, except that the product must contain as many decimals as are contained in the multiplicand and multiplier. If the product does not contain the required number of figures, supply the deficiency by placing ciphers to the left.

Examples: A ship sails 5.6 miles per hour for 4.7 hours. Find the distance run. Also find how far she will run in 7.3 hours at the same rate of speed.

Speed per hour	5.6	Speed per hour	5.6
Hours run	× 4.7	Hours run	× 7.3
	392		168
	224		392
Dist. in Miles=	26.32	Dist. in Miles=	40.88

DIVISION.

Place the divisor and dividend the same as in whole numbers. Move the decimal point in the dividend to the right as many places of figures as there are decimals in the divisor. Then treat the divisor as a whole number and proceed as in whole numbers. The number of decimals in the quotient will be the same as the number of decimals in the dividend, remembering that the decimal point in the dividend has been moved to the right, provided there are decimals in the divisor.

Example: A ship sails 7.8 miles in 7h.5. What is her speed per hour, and if she runs 14.3 miles in 1.7, what will be her speed per hour?

```
7h.5)7'.8,00(1.04        1h.7)14'.3,00(8.41+
     75                       136
     ---                      ---
     300                       70
     300                       68
                               --
                               20
                               17
                               --
                                3
```

Ans. 1.04 per hour. Ans. 8.41 + per hour.

REDUCTION.

For convenience in performing the various operations in arithmetic, it becomes necessary to turn vulgar fractions into decimals and decimals into vulgar fractions.

To reduce a vulgar fraction to a decimal, place a decimal point to the right of the numerator, and to the right of the decimal point place as many ciphers as may be necessary and then divide the numerator by the denominator, and the quotient will be the required decimal and must contain as many figures as are contained in the dividend.

In this operation, such fractions as 9 inches would be expressed $\frac{9}{12}$, 27 minutes $\frac{27}{60}$, and 6 hours $\frac{6}{24}$, as there are 12 inches to a foot, 60 minutes to an hour and 24 hours to a day.

Examples: Reduce 33 minutes and 51 minutes to decimals of an hour.

```
60)33m.00(.55        60)51m.00(.85
   30  0                 48  0
   ---                   ---
    3 00                  3 00
    3 00                  3 00
```

Ans. 33m. = .55 of an hour. Ans. 51m. = .85 of an hour.

Examples: Reduce ⅛ of a mile and 3 hours to decimals.

```
8)1.000(.125        24)3.000(.125
   8                   24
   ---                 --
   20                  60
   16                  48
   --                  --
   40                  120
   40                  120
```

Ans. ⅛ mile = .125 of a mile. Ans. 3 hours = .125 of a day.

Navigators generally reduce the minutes of an hour to a decimal mentally, as they do not require more than one or two decimal places. It is only necessary to take the number of times 6 is

contained in the number of minutes as the number of tenths. This is made possible because 6 is one-tenth of 60.

To reduce a decimal to days, hours, fathoms, feet or inches, as the case may require, multiply the decimal by the number of parts in the unit to which the reduction is desired.

Examples: Reduce 8.75 fathoms to feet and inches. And 2.25 feet to inches.

8.75	2.25
× 6	× 12
52.50	450
× 12	225
100	27.00
50	
6.00	

Ans. 52 feet and 6 inches. Ans. 27 inches.

Examples: Reduce 5.56 days to days, hours, minutes and seconds. And 2.56 hours.

5d.56	2h.56
× 24	× 60
224	33.60
112	60
13.44	36.00
× 60	
26.40	
× 60	
24.00	

Ans. 5d 13h 26m 24s. Ans. 2h 33m 36s.

TO USE LOGARITHMS.

The various operations in arithmetic may be performed by logarithms at a saving of considerable time and labor. They so shorten and simplify mathematical calculations that the results obtained can be relied on as correct.

A logarithm consists of two parts; the characteristic or index and the mantissa or decimal part, The decimal part is found in table 42 and the index must be supplied. Having obtained the logarithm from table 42 corresponding to a certain number, the index is always one less than the number of figures in the number to the left of the decimal point. The logarithm of a number that is a decimal is found in table 42, the same as a whole number. The index of a logarithm of a decimal is always 9 when no ciphers immediately follow the decimal point. For every cipher following the decimal point, deduct one from nine and then the result will be the required index.

The following table will show the index for all numbers in ordinary use:

Number.	Index.	
4852.	3.	
485.2	2.	
48.52	1.	
4.852	0.	
.4852	9.	log. .68592
.04852	8.	
.004852	7.	
.0004852	6.	

This table shows that the logarithm with the exception of the index is the same for each number.

This logarithm .68592 is from table 42. In the left hand column 485 is found and at the top or bottom the 2 is found. At the intersection .68592 is found.

MULTIPLICATION.

To multiply one number by another, take the logarithms from table 42 for each number and add them together. Their sum, rejecting 10 of the index if it exceeds 9, will be the logarithm of the product of the two numbers. Find this logarithm in table 42 and the corresponding number will be the required quantity.

Example: A ship makes 12⅝ miles per hour. What distance will she run in 5h 45m?

12′⅝ = 12′.6	log.	1.10037	table 42, page	391.
5h 45m=5h.75	"	+ .75967	" 42, "	398.
Dist. 72′.45 =	"	1.86004	" 42, "	401.

Example: Multiply .51 by .07.

.51	log.	9.70757	table 42, page	397.
.07	"	+ 8.84510	" 42, "	401.
.0357 =	"	8.55267	" 42, "	395.

DIVISION.

To divide one number by another, take their corresponding logarithms from table 42 and supply the index as explained under multiplication. Subtract the logarithm of the divisor from that of the dividend, and the result will be the logarithm of the quotient. If the dividend is less than the divisor, the index of its logarithm must be increased by adding 10 to it.

Example: A ship runs $93\frac{1}{10}$ miles in 7h 36m, what is her speed per hour?

93′ 1-10		93′.1	log.	1.96895	table	42,	page	404.
7h 36m	=	7h 6	" —	.88081	"	42,	"	402.
Speed		12′25	= "	1.08814	"	42,	"	391.

Example: Divide .61 by .8.

.61		"	19.78533	table	42,	page	399.
.8		"	= 9.90309	"	42,	"	402.
.7625	=	"	9.88224	"	42,	"	402.

TO EXTRACT ANY ROOT.

Without the use of logarithms, more or less difficulty is attached to this operation; but with logarithms it is very simple, as it is only necessary to take the logarithm of the number from table 42, and divide it by the index of the required root. By this method it is no more difficult to extract the cube root than the square root.

Example: Extract the square root of 2304. This expression is properly written $\sqrt{2304}$.

2304		log.	2)3.36248	table 42, page 398.
48.	—	"	1.68124	" 42, " 397.

Example: $\sqrt{529}$.

529		log.	2)2.72346	table 42, page 398.
23	—	"	1.36173	" 42, " 393.

Example: Extract the cube root of 729. This expression is properly written $\sqrt[3]{729}$

729		log.	3)2.86273	table 42, page 401.
9	—	"	.95424	" 42 " 404.

Example: Square 27. This expression is written 27^2.

27		log.	1.43136	table 42, page 393.
		index	× 2	
729	—	log.	2.86272	" 42, " 401.

Example: 4^3 which means that 4 is to be cubed or raised to the third power.

4		log.	.60206
		index	× 3
64	—	log.	1.80618

Decimal Equivalents of Sixtieths.

In every calculation in navigation it is necessary to reduce seconds (″) to a decimal part of a mile; seconds (s) to a decimal part of a minute; minutes (m) to a decimal part of an hour, and the contrary. The following table contains the decimal equivalent for every sixtieth:

″ or ″ m. or s.	Decimal.	′ or ″ m. or s.	Decimal.	′ or ″ m. or s.	Decimal.	′ or ″ m. or s.	Decimal.
1	.017	16	.267	31	.517	46	.767
2	.033	17	.283	32	.533	47	.783
3	.05	18	.30	33	.55	48	.80
4	.067	19	.317	34	.567	49	.817
5	.083	20	.333	35	.583	50	.833
6	.10	21	.35	36	.60	51	.85
7	.117	22	.367	37	.617	52	.867
8	.133	23	.383	38	.633	53	.883
9	.15	24	.40	39	.65	54	.90
10	.167	25	.417	40	.667	55	.917
11	.183	26	.433	41	.683	56	.933
12	.20	27	.45	42	.70	57	.95
13	.217	28	.467	43	.717	58	.967
14	.233	29	.483	44	.733	59	.983
15	.25	30	.50	45	.75	60	1.00

Examples: 8s. — 0m. .133. 26′ — 0′ .433. 44m. — 0h. .733.

Astronomical Signs.

SIGNS OF THE PLANETS.

☉ The Sun.	⊕ The Earth.	♄ Saturn.
☾ The Moon.	♂ Mars.	♅ Uranus.
☿ Mercury.	♃ Jupiter.	♆ Neptune.
♀ Venus.		

SIGNS OF THE ZODIAC.

Spring Signs.	Summer Signs.	Autumn Signs.	Winter Signs.
1 ♈ Aries.	4 ♋ Cancer.	7 ♎ Libra.	10 ♑ Capricornus.
2 ♉ Taurus.	5 ♌ Leo.	8 ♏ Scorpius.	11 ♒ Aquarius.
3 ♊ Gemini.	6 ♍ Virgo.	9 ♐ Sagittarius.	12 ♓ Pisces.

☌ Conjunction, or having the same Longitude or Right Ascension.
□ Quadrature, or differing ± 90° in Longitude or Right Ascension.
☍ Opposition, or differing 180° in Longitude or Right Ascension.

☊ Ascending Node.	E. East.	″ Seconds of Arc.
☋ Descending Node.	W. West.	h Hours.
N. North.	° Degrees.	m Minutes of Time.
S. South.	′ Minutes of Arc.	s Seconds of Time.

Middle Latitude Sailing.

This method is chiefly used for finding the course and distance between ports not far apart and for working the latitude and longitude up to the instant of observation, and embraces what is termed as Parallel Sailing. For obtaining longitude by account, it is indispensable.

When the course and distance between two ports are required, find the differences of their latitudes and longitudes. Then find the middle latitude by adding together the latitudes of the places and dividing the sum by 2. With this middle latitude, enter table 2 as if a course, and find the difference of longitude in the distance column, and the corresponding number in the latitude column will be the departure. Then with the difference of latitude and departure, enter table 2, and where they are found to agree nearest in their respective columns, will give the course and distance on the same page. If the difference of latitude is greater than the departure, read from the top of the page; but if the departure is the greater, read from the bottom.

Example: Find the course and distance from Barnegat light to Fire Island light.

Lat. Barnegat	39°	45′	52″	N.	Long. Barnegat	74°	06′	24″ W.
" Fire Island	40	37	57	N.	" Fire Island	73	13	08 W.
Diff. lat. 52′.1 =		52	05	N.	Diff. long. 53′.3 =		53	16 E.

Lat. Barnegat	39°	45′	52″	N.
" Fire Island	40	37	57	N.
2)	80	23	49	
Middle lat.	40	11	54	= 40° Diff. long. 53′.3 = Dep. 40′.6 E.

Diff. lat. 52′.1 N. } = Course N. 38° E., dist. 66 miles.
Dep. 40′.6 E. }

Example: Find the course and distance from Mount Desert Rock to Cape St. Mary.

Lat. Mt. Desert	43°	58′	08″	N.	Long. Mt. Desert	68°	07′	44″ W.
" Cape St. Mary	44°	05	20	N.	" Cape St. Mary	66	12	30 W.
Diff. lat. 7′.2 =		07	12	N.	Diff. long 115′.2 =	1	55	14 E.

Lat. Mt. Desert	43°	58′	08″	N.
" Cape St. Mary	44	05	20	N.
2)	88	03	28	
Middle lat.	44	01	44	= 44° Diff. long. 115′.2 = Dep. 82′.7 E.

Diff. lat. 7′.2 N. } = Course N. 85° E., dist. 83 miles.
Dep. 82.7 E. }

Mercator's Sailing.

When the course and distance between two ports are required, find the differences of their latitudes and longitudes as in Middle Latitude Sailing. Then from table 3 take the meridional parts corresponding to each latitude, and their difference will be the meridional difference of latitude. Enter table 2 with the meridional difference of latitude in the latitude column, and the difference of longitude in the departure column, and where they are found to agree nearest, the course will be given. On the same page, find the proper difference of latitude in the latitude column, and the corresponding number in distance column will be the required distance.

If the meridional difference of latitude is greater than the difference of longitude, read from the top of the page; but if the difference of longitude is greater, read from the bottom.

Example: Find the course and distance from Great Inagua Island light to Baracoa, Cuba.

Lat. Inagua Is.	20° 56′ 00″ N.	Mer. Parts	1276′.7 N.	Long. Inagua Is.	73° 40′ 17″ W.
" Baracoa	20 21 40 N.	" "	1240 .6 N.	" Baracoa	74 29 34 W.
Diff. lat. 34′.3 =	34 20 S.	" diff. lat.	36 .1 S.	Diff. long. = 49′.3	49 17 W.

Mer. diff. lat. 36′.1 S.
Diff. long 49 .3 W. } = Course S. 54° W.

Proper diff. lat. 34′.3 = Dist. 58 miles.

Example: Find the course and distance from Cape Maysi light to Castle Island light.

Lat. C. Maysi	20° 15′ 10″ N.	Mer. Parts	1233′.2 N.	Long. C. Maysi	74° 09′ 41″ W.
" Castle Is.	22 06 40 N.	" "	1352 .6 N.	" Castle Is.	74 19 26 W
Diff. lat. 111′.5 =	1 51 30 N.	" diff. lat.	119 .4 N.	Diff. long. 9′.7 =	9 45 W.

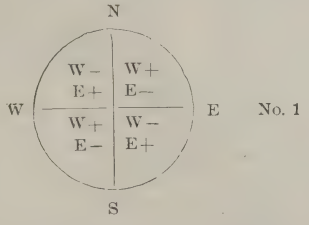
Mer. diff. lat 119′.4 N.
Diff. long 9 .7 W. } = Course N. 5° W.

Proper diff. lat. 111′.5 = Dist. 112 miles.

Correcting Courses.

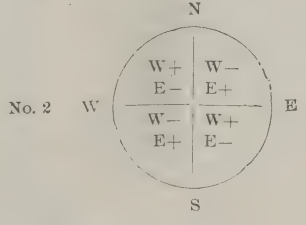
The true course is the result of the calculation to find the course between any two ports. To steer that course by the ship's compass, it must be reduced to a compass course. On the other hand, when a ship's course by compass is given, it must be reduced to a true course that it may be used in table 2. The two compasses are given to facilitate these operations.

Compass No. 1 is for turning true courses into magnetic or compass courses. Compass No. 2 is for turning compass or magnetic courses into true courses.



No. 1

No. 2



To turn a true course into a compass course, apply the variation, deviation, etc., according to the signs in that quadrant in which the course falls in compass No. 1.

Example: The true course from Barnegat light to Fire Island light is N. 38° E. Variation of the compass is 9° W. Deviation of the ship's compass for that course is 3° E.

True course	N. 38° E.
Variation	+ 9 W.
Magnetic course	N. 47 E.
Deviation	— 3 E.
Compass course	N. 44 E.

To turn a compass course into a true course, apply the variation, deviation, etc., according to the signs in compass No. 2.

Example: A ship sailed the course, S. 54° E., by compass. The variation was 8° E., and deviation 6° E.

Compass course	S. 54° E.
Variation	— 8 E.
Magnetic course	S. 46 E.
Deviation	+ 6 W.
True course	S. 52 E.

The Mariner's Compass

SHOWING EVERY POINT AND DEGREE

The above is the Navy method of boxing the compass.

TABLE FOR TURNING COMPASS POINTS INTO DEGREES AND THE CONTRARY.

N. to E.	N. to W.	Points	°	′	″	S. to E.	S. to W.
N.	N.	0.	0°	0′	0″	S.	S.
N. ¼ E.	N. ¼ W.	¼	2	48	45	S. ¼ E.	S. ¼ W.
N. ½ E.	N. ½ W.	½	5	37	30	S. ½ E.	S. ½ W.
N. ¾ E.	N. ¾ W.	¾	8	26	15	S. ¾ E.	S. ¾ W.
N. by E.	N. by W.	1	11	15	0	S. by E.	S. by W.
N. by E. ¼ E.	N. by W. ¼ W.	1¼	14	3	45	S. by E. ¼ E.	S. by W. ¼ W.
N. by E. ½ E.	N. by W. ½ W.	1½	16	52	30	S. by E. ½ E.	S. by W. ½ W.
N. by E. ¾ E.	N. by W. ¾ W.	1¾	19	41	15	S. by E. ¾ E.	S. by W. ¾ W.
N. N. E.	N. N. W.	2.	22	30	0	S. S. E.	S. S. W.
N. E. by N. ¾ N.	N. W. by N. ¾ N.	2¼	25	18	45	S. E. by S. ¾ S.	S. W. by S. ¾ S.
N. E. by N. ½ N.	N. W. by N. ½ N.	2½	28	7	30	S. E. by S. ½ S.	S. W. by S. ½ S.
N. E. by N. ¼ N.	N. W. by N. ¼ N.	2¾	30	56	15	S. E. by S. ¼ S.	S. W. by S. ¼ S.
N. E. by N.	N. W. by N.	3.	33	45	0	S. E. by S.	S. W. by S.
N. E. ¾ N.	N. W. ¾ N.	3¼	36	33	45	S. E. ¾ S.	S. W. ¾ S.
N. E. ½ N.	N. W. ½ N.	3½	39	22	30	S. E. ½ S.	S. W. ½ S.
N. E. ¼ N.	N. W. ¼ N.	3¾	42	11	15	S. E. ¼ S.	S. W. ¼ S.
N. E.	N. W.	4.	45	0	0	S. E.	S. W.
N. E. ¼ E.	N. W. ¼ W.	4¼	47	48	45	S. E. ¼ E.	S. W. ¼ W.
N. E. ½ E.	N. W. ½ W.	4½	50	37	30	S. E. ½ E.	S. W. ½ W.
N. E. ¾ E.	N. W. ¾ W.	4¾	53	26	15	S. E. ¾ E.	S. W. ¾ W.
N. E. by E.	N. W. by W.	5.	56	15	0	S. E. by E.	S. W. by W.
N. E. by E. ¼ E.	N. W. by W. ¼ W.	5¼	59	3	45	S. E. by E. ¼ E.	S. W. by W. ¼ W.
N. E. by E. ½ E.	N. W. by W. ½ W.	5½	61	52	30	S. E. by E. ½ E.	S. W. by W. ½ W.
N. E. by E. ¾ E.	N. W. by W. ¾ W.	5¾	64	41	15	S. E. by E. ¾ E.	S. W. by W. ¾ W.
E. N. E.	W. N. W.	6.	67	30	0	E. S. E.	W. S. W.
E. by N. ¾ N.	W. by N. ¾ N.	6¼	70	18	45	E. by S. ¾ S.	W. by S. ¾ S.
E. by N. ½ N.	W. by N. ½ N.	6½	73	7	30	E. by S. ½ S.	W. by S. ½ S.
E. by N. ¼ N.	W. by N. ¼ N.	6¾	75	56	15	E. by S. ¼ S.	W. by S. ¼ S.
E. by N.	W. by N.	7.	78	45	0	E. by S.	W. by S.
E. ¾ N.	W. ¾ N.	7¼	81	33	45	E. ¾ S.	W. ¾ S.
E. ½ N.	W. ½ N.	7½	84	22	30	E. ½ S.	W. ½ S.
E. ¼ N.	W. ¼ N.	7¾	87	11	15	E. ¼ S.	W. ¼ S.
E.	W.	8.	90	0	0	E.	W.

BACK LABEL IN NORWEGIAN.

"NEW JERSEY"

EN MÆRKVÆRDIG KJENDSGJERNING.

DETTE Billede er en Kopi af et Fotografi taget af et Stykke Bord, den ene Ende af hvilket var malet med NEW JERSEY KOBBERSTOF, fabrikeret af Harry Louderbough, Indehaver af NEW JERSEY PAINT WORKS, Jersey City, N. J., U. S. A. Hele Bordet blev sænket under Vand ved Port Royal, S. C. Efter 5 Maaneders Forlöb blev det optaget. Billedet viser hvorledes Saltvandsormen, en Fjende til alt Træ, har ödelagt den umalede Ende, ligeledes den Mængde Barnakler der har sat sig paa den.

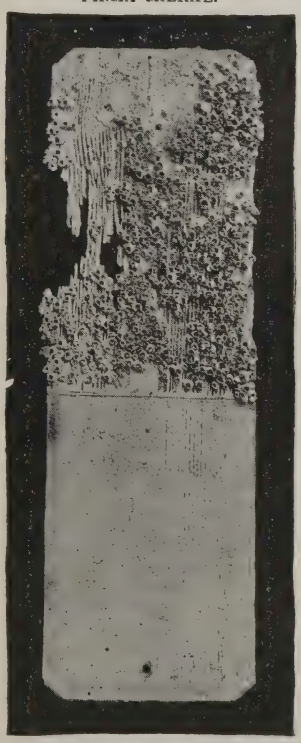
Læg Mærke til den malede Ende, hvortil New Jersey Kobberstof blev brugt—hvor fortrinlig den har holdt sig.

Bordet her fremstillet satte jeg i Söen ved Port Royal, S. C., og lod det staa i Vandet i 5 Maaneder. Den malede Ende fandt jeg saa god, som da jeg satte den ned.

MILLS EDWARD,
Förer af Skonnerten "Florence Shay."

Kun et maerke og dette det beste.

FIRMA MÆRKE.



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The Mercator Chart and Its Use.

From the various projections upon which charts are constructed, the Mercator is selected as best meeting the requirements for the purposes of the practical navigator. The chart was first published by Gerard Mercator, a Flemish geographer, in 1569, and it seems that he never disclosed the principles upon which it was constructed. . However, the Mercator charts now used are constructed on a well known theory, and fully satisfy the demands of the navigator, except for obtaining the great circle track, and this track when found is usually laid off on this chart. On account of the great difference between the degree of longitude and that of latitude, the chart is not so desirable above about 70°, and for that reason the table of meridional ports is not computed beyond 80°.

The chart is constructed on the theory that the earth's surface is a cylinder tangent to the equator. This necessitates the meridians being parallel to each other, while on the sphere they contract towards the poles. The distances between the successive parallels of latitude are increased towards the poles in the same proportion that the meridians have been expanded. It then follows that on this chart the degree of longitude is everywhere equal or of uniform length, and the degree of latitude constantly increasing in length towards the poles. The result of this is a plane chart upon which every place is in its proper geographical position, and on their proper bearings from each other. All courses and bearings are shown as straight lines, except the great circle track, which is a curve, except when the two points bear north and south from each other.

To lay off a course on this chart, draw a straight line between the two points, and to measure a distance in any direction the miles must be taken from the graduated meridian at either side of the chart in the middle latitude of the latitudes of the places or points under consideration. The miles for measuring difference of longitude is taken from the graduated parallel of latitude in any longitude at either the top or bottom of the chart. In convenient places there are true compasses, inside of each is a magnetic compass. In using these compasses, the one on the line of equal variation to which the ship is nearest must be used.

On the land portion of these charts will be found connsiderable data, such as the date to which corrected, a description of the lights, their distance visible, information of tides, unit used for soundings, abbreviations, etc. Before the chart is used it should be examined and all the data read until it is thoroughly understood. It is advisable to have any book of sailing directions, coast pilots or other information that usually go with charts and are properly a part of them. Always use the latest charts.

Thermometer.

There are three thermometer scales in general use and when a temperature is recorded the name of the scale is usually given. For various reasons it is at times necessary to convert the reading by one thermometer scale into that of another.

The Fahrenheit scale is divided into 180 equal parts, called degrees, between the freezing point and the boiling point of water. From 32° below the freezing point, which is the zero, the degrees are counted to 212° or more. The same scale is extended any convenient number of degrees below the zero.

The centigrade scale is divided into 100 equal parts between the freezing and boiling points, the freezing point being the zero from which the degrees are read each way.

The Reaumer scale is similar to the centigrade, except that it is divided into 80 equal parts between the freezing and boiling points.

By the following rules the reading of any thermometer scale may be converted into that of another:

FAHRENHEIT TO CENTIGRADE.

$$\text{Centigrade} = \frac{\text{Degrees Fahr. } \mathcal{O} 32^\circ}{9} \times 5$$

FAHRENHEIT TO REAUMER.

$$\text{Reaumer} = \frac{\text{Degrees Fahr. } \mathcal{O} 32^\circ}{9} \times 4$$

CENTIGRADE TO FAHRENHEIT.

$$\text{Fahrenheit} = \left(\frac{\text{Degrees Centi.}}{5} \times 9\right) + 32^\circ$$

REAUMER TO FAHRENHEIT.

$$\text{Fahrenheit} = \left(\frac{\text{Degrees, Reaumer}}{4} \times 9\right) + 32^\circ$$

CENTIGRADE TO REAUMER.

$$\text{Reaumer} = \frac{\text{Degrees Centi.}}{5} \times 4$$

REAUMER TO CENTIGRADE.

$$\text{Centigrade} = \frac{\text{Degrees Reaumer}}{4} \times 5$$

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Mercator and Middle Latitude Sailings by Computation.

The course and distance between any two ports not far apart or for a short run may be found by inspection with sufficient degree of accuracy for general purposes; but when very exact courses and distances are required, the result obtained by inspection will not answer and it is necessary that they be computed, using logarithms to facilitate the operation.

While the earth has no true geometrical figure, it is nearer that of an oblate spheriod than any other; but for about 15° each side of the equator it is more nearly spherical than elsewhere. Because of the irregularity of the earth's form, a course and distance found by both Mercator and middle latitude sailings cannot always agree exactly and neither can be absolutely correct.

In many works on navigation, the earth is considered a perfect sphere, with the result that the tables of meridional parts are more or less in error, and above latitude about 15° this error becomes some considerable, and in consequence the course and distance found by Mercator sailing is not exactly correct.

The same writers in handling middle latitude sailing, neglect a necessary correction to the mean or middle latitude, and therefore the courses and distances so obtained are also incorrect, the error being different in different latitudes.

In consequence of the above, there are certain conditions where Mercator sailing will give a more satisfactory result than the middle latitude method, and vici versa, and only in cases where the course is 45° will the result of both methods nearly correspond.

The latest edition of Bowditch contains a new table of meridional parts and a middle latitude correction which conforms very nearly with the figure of the earth, and in the solution of the following problems those tables and no others are used.

The following tables, containing all the necessary rules for the solution of the various problems, are from Bowditch:

MIDDLE LATITUDE SAILING.

Case	Given.	To Find.	Solutions.
1	Both latitudes and longitudes.	Departure Course Distance	Dep. = D. Lo. × cos Mid. L. Tan. C. = Dep. ÷ D. L. or tan C. = (cos Mid. L. × D. Lo.) ÷ D. L. Dist. = sec C. × D. L. or Dist. = Dep. ÷ sin C.
2	Both latitudes and departure.	Course Distance Difference of longitude	Tan. C. = Dep. ÷ D. L. Dist. = Dep. ÷ sin C. D. Lo. = Dep. ÷ cos Mid. L.
3	One latitude, course and distance.	Difference of latitude Departure Difference of longitude	D. L. = Dist. × cos C. Dep. = Dist. × sin C. D. Lo. = Dep. × sec Mid. L. or (Dist. × sin C. × sec Mid. L.)
4	Both latitudes and course	Departure Distance Difference of longitude	Dep. = D. L. × tan C. Dist. = D. L. ÷ cos C. D. Lo. = Dep. × sec Mid. L. or D. L. × tan C × sec Mid. L.
5	Both latitudes and distance.	Course Departure Difference of longitude	Cos C. = D. L. ÷ Dist. Dep. = Dist. × sin C. D. Lo. = Dep. × sec Mid. L.
6	One latitude, course and departure.	Difference of latitude Distance Difference of longitude	D. L. = Dep. ÷ tan C. Dist. = Dep. ÷ sin C. D. Lo. = Dep. × sec Mid. L.
7	One latitude, distance and departure.	Course Difference of latitude Difference of longitude	Sin C. = Dep. ÷ Dist. D. L. = Dist. × cos. C. D. Lo. = Dep. × sec Mid. L.

MERCATOR SAILING.

Case.	Given.	To Find.	Solutions.
1	Both latitudes and longitudes.	Course	Tan C. = D. Lo. ÷ m.
		Distance	Dist. = sec C. × D. L.
			Dist. = D. L. ÷ cos C.
		Departure	Dep. = D. L. × tan C.
			Dep. = (D. L. × D. Lo.) ÷ m.
2	Both latitudes and departure.	Course	Tan C. = Dep. ÷ D. L.
		Distance	Dist. = D. L. × sec C.
			Dist. = Dep. ÷ sin C.
		Difference of longitude	D. Lo. = m. × tan C.
			D. Lo. = (Dep. × m. ÷ D. L.
3	One latitude, course and distance	Departure	Dep. = Dist. × sin C.
		Difference of latitude	D. L. = Dist. × cos C.
		Difference of longitude	D. Lo. = m. × tan C.
4	Both latitudes and course.	Distance	Dist. = D. L. ÷ cos C.
		Departure	Dep. = D. L. × tan C.
		Difference of longitude	D. Lo. = m. × tan C.
5	Both latitudes and distance.	Course	Cos C. = D. L, ÷ Dist.
		Departure	Dep. = Dist. × sin C.
		Difference of longitude	D. Lo. = m. × tan C.
6	One latitude, course and departure.	Difference of latitude	D. L. = Dep. ÷ tan C.
		Distance	Dist. = Dep. ÷ sin C.
		Difference of longitude	D. Lo. = m. × tan C.
			D. Lo. = (Dep. × m.) ÷ D. L.
7	One latitude, distance, and departure.	Course	Sin C. = Dep. ÷ Dist.
		Difference of latitude	D. L. = Dist. × cos C.
		Difference of longitude	D. Lo. = m. × tan C.
			D. Lo. = (Dep. × m.) ÷ D. L.

Example: Find the course and distance from Sandy Hook light ship to Port San Juan, Porto Rico.

BY MIDDLE LATITUDE SAILING

Lat. S. H. L. S.	40°	28′	00″	N.	Long. S. H. L. S.	73°	50′	00″ W.
Lat. P. S. J.	18	28	23	N.	Long. P. S. J.	66	07	26 W.
Diff. lat. 1319′.6 =	21	59	37	S.	Diff. long. 462′.6 =	7	42	34 E.

In the table containing the correction to be applied to the middle latitude, the difference of latitude is limited to 20°, and in consequence it is necessary to compute the middle latitude, using the formula:

$$\text{Mid. lat.} = \frac{\text{prop. diff. lat.}}{\text{mer. diff. lat.}}$$

which will be found on page 54, Bowditch, new edition.

Lat. S. H. L. S.	40°	28′	00″	N.	Mer. Parts	2644′.2	Prop. diff. lat.	1319′.6 log. 3.12044
Lat. P. S. J.	18	28	23	N.	" "	1120.4	Mer. diff. lat.	1523.8 " 3.18292
					" diff. lat.	1523.8S	Mid. lat. 30°	— cos. 9.93752

Diff. long. 462′.6	log.	2.66521	Course S. 16° 53′ E.	sec. .01913
Mid. lat. 30°	cos.	9.93752	Prop. diff. lat. 1319′.6	log. 3.12044
Dep. 400′.6	— log.	2.60273	Distance 1379′	— log. 4.13957
Prop. diff. lat. 1319′.6	"	3.12044		
Course S. 16° 53′ E.	—tang.	9.48229		

BY MERCATOR SAILING.

Diff. long. 462′.6 E.	log.	2.66521	Prop. diff. lat. 1319′.6	log.	3.12044
Mer. diff. lat. 1523′.8 S.	log.	3.18292	Course S. 16° 53′ E.	cos.	9.98087
Course S. 16° 53′ E.	tang.	9.48229	Distance 1379′.	— log.	3.13957

Day's Work, or Keeping Track of the Ship by Dead Reckoning.

The first course and distance is the bearing (reversed) of the point of departure and the distance off. Construct a traverse table, and in it place each course and distance sailed, and the leeway, variation and deviation. If the ship is sailing in a current, its drift and direction must be considered a course, as if the ship had really sailed it. Correct the courses for leeway, variation and deviation. With the corrected courses enter table 2, and take out the corresponding differences of latitude and departures and place them in their respective columns. Add up each column separately, and then find the differences between the latitude columns and the departure columns. The remainder of this work is explained in Middle Latitude Sailing.

Example: A ship had Barnegat light bearing S. W. by W. distance 9 miles, deviation for the ship's head 14° E. She then sailed as follows: S. E. by E. ½ E. 42 miles, deviation 3° W.; S. W. by W. 38 miles, deviation 5° E.; E. S. E. 34 miles, deviation 3° W.; S. W. 48 miles, deviation 4° E.; S. E. by E. 69 miles, deviation 3° W. On all these courses the ship made a half point leeway, and the variation of the compass is 9° W. A current ran N. E. (magnetic) at 1¾ knots per hour throughout the twenty-four hours, during which time the wind was southerly. Find the course and distance made good from Barnegat light, and the latitude and longitude in by middle latitude sailing. Then find the course and distance to Cape Hatteras light by Mercator's sailing.

TRAVERSE TABLE.

Compass Course. (Points)	Compass Course. (Degrees)	Leeway.	Var.	Dev.	Corrected Courses.	Dist. (Miles)	Diff. Lat. N.	Diff. Lat. S.	Dep. E.	Dep. W.
N. E. by E.	N. 56° 15′ E.		9° W.	14° E.	N. 61° 15′ E.	9	4.4		7.9	
S. E. by E. ½ E.	S. 61 52 E.	½ Pt.	9 W.	3 W.	S. 79 29 E.	42		8.0	41.2	
S. W. by W.	S. 56 15 W.	½ "	9 W.	5 E.	S. 57 52 W.	38		20.1		32.2
E. S. E.	S. 67 30 E.	½ "	9 W.	3 W.	S. 85 07 E.	34		3 0	33.9	
S. W.	S. 45 00 W.	½ "	9 W.	4 E.	S. 45 37 W.	48		33.3		34.5
S. E. by E.	S. 56 15 E.	½ "	9 W.	3 W.	S. 73 52 E.	69		19.0	66.3	
N. E.	N. 45 00 E.		9 W.		N. 36 00 E.	42	34.0		24.7	
							38.4	83.4	174.0	66 7
								38.4	66.7	
								45.0	107.3	

Lat. Barnegat 39° 45′ 52″ N. Long. Barnegat 74° 06′ 24″ W.
Diff. lat. 45 00 S. Diff. long 2 18 00 E.
Lat. of ship. 39 00 52 N. Long. of ship 71 48 24 W.

Lat. Barnegat 39° 45′ 52″ N.
" of ship 39 00 52 N.
2)78 46 44
Middle lat. 39 23 22 = 39° Dep. 107′.3 = diff. long. 138′ E.

Diff. lat. 45′.0 S. } = Course S. 67° E., dist. 116 miles.
Dep. 107. 3 E. }

Lat. of ship 39° 00′ 52″ N. Mer. Parts 2531.8 N. Long. of ship 71° 48′ 24″ W.
" C. Hatteras 35 15 17 N. " " 2249.4 N. " C. Hatteras 75 31 16 W.
Diff. lat. 225′.6 = 3 45 35 S. " diff. lat. 282.4 S. Diff. long. 222′.9 = 3 42 52 W.

Mer. diff. lat. 282.4 S. } = Course S. 38° W.
Diff. long. 222.9 W. }

Proper diff. lat. 225′.6 = dist. 286.5 miles.

Example: A ship had Montauk Point light bearing N. W. by N. distance 12 miles, and then sailed as follows: S. by W. 17 miles, S. S. E. 28 miles, E. N. E. 42 miles, W. N. W. 44 miles. The variation of the compass is 11° W. throughout. A current set E. N. E. (magnetic) at ¾ knots per hour throughout the twenty-four hours. Find the course and distance made good from Montauk Point, and the latitude and longitude in by middle latitude sailing. Then by Mercator's sailing, find the course and distance to Five Fathom Bank Light Ship.

Do you know that the Sun never sets on the American Flag,
and that "New Jersey" Copper Paint encircles the world?

TRAVERSE TABLE.

Compass Course. (Points)	Compass Course. (Degrees)	Lee-way.	Var.	Dev.	Corrected Courses.	Dist. (Miles)	Diff. Lat. N.	Diff. Lat. S.	Dep. E.	Dep. W.
S. E. by S.	S. 34° E.		11° W.		S. 45° E.	12		8.5	8.5	
S. by W.	S. 11 W.		11 W.		S.	17		17.0		
S. S. E.	S. 22 E.		11 W.		S. 33 E.	28		23.5	15.2	
E. N. E.	N. 67 E.		11 W.		N. 56 E.	42	23.5		34.8	
W. N. W.	N. 67 W.		11 W.		N. 78 W.	44	9.1			43.0
E. N. E.	N. 67 E.		11 W.		N. 56 E.	18	10.1		14.9	
							42.7	49.0	73.4	43.0
								42.7	43.0	
								6.3	30.4	

Lat. Montauk Pt. 41° 04′ 16″N. Long. Montauk Pt 71° 51′ 27″W.
Diff. lat. 6 18 S. Diff. long. 40 12 E.
Lat. of ship 40 57 56 N. Long. of ship 71 11 15 W.

Lat. Montauk Pt. 41° 04′ 16″N.
Lat. of ship 40 57 56 N.
2)82 02 12
Middle lat. 41 01 06 = 41° Dep. 30′.4 = diff. long. 40′.2 E.

Diff. lat 6′.3 S.
Dep. 30′.4 E. } = Course S. 78° E., dist. 31 miles.

Lat. of ship 40° 57′ 56″ N. Mer. Parts 2683′.9 N. Long. of ship 71° 11′ 15″W.
Lat. F. F. B. L. ship 38 47 20 N. " " 2513 .8 N. Long. F. F. B. L. ship 74 34 36 W.
Diff. lat. 130′.6 = 2 10 36 S. " diff. lat. 170 .1 S. Diff. long. 203′.3 = 3 23 21 W.

Mer. diff. lat. 170′.1 S.
Diff. long. 203′.3 W. } = Course S. 50° W

Proper diff. lat. 130′.6 = dist. 203 miles.

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Example: Fire Island light bore by compass N.N.W. distant 16′.4. Ship's head S.E.½E. Variation 9° 30′ W. A current set N.E. (magnetic) throughout the day at the rate of ⅝ mile per hour. The ship was then sailed as follows:

Course	Wind	Leeway	Dist.
S. ½ E.	S.E. by E.	1½ Pt.	50′.2
S.E. ½ S.	E. by N.	½ Pt.	40 .7
E. by N.	S.E.	4°	32 .6

Deviations as shown by the table.

Find the course and distance made good and the latitude and longitude in and from that position find the course and distance to Mona Island by Mercator sailing.

Compass Courses	Wind	Leeway	Var.	Dev.	Dist.	Corrected Courses	Dif. lat. N.	Dif. lat. S.	Dep. E.	Dep. W.
S.S.E.			9° 30′ W.	12° 30′ E.	16′.4	S. 19° 30′ E.		15′.5	5′.5	
S. ½ E.	S.E. by E.	1½ Pt.	9 30 W.	1 30 W.	50 .2	S. 0 15 W.		50 .2		
S.E. ½ S.	E. by N.	½ Pt.	9 30 W.	9 30 E.	40 .7	S. 33 45 E.		33 .7	22 .8	
E. by N.	S.E.	4°	9 30 W.	25 00 E.	32 .6	S. 89 45 E.			32 .6	
N.E.			9 30 W.		15 .0	N. 35 30 E.	12′.3		8 .6	
							12 .3	99 .4	69 .5	
								12 .3		
								87 .1		

Lat. F. I.	40° 37′ 57″ N.	M. P.	2657′.3	Long. F. I.	73° 13′ 08″ W.
Dif.	— 1 27 6 S.	"	2544 .3	Dif.	— 1 30 10 E.
Lat. ship	39 10 51 N.	Dif.	113 .0 S.	Long. ship	71 42 58 W.

Dep.	69′.5 E.		1.84198	Co. 38° 45′	sec.	.10696
Mer. dif.	113 .0 S.	+	2.05308	Prop. dif. lat. 87′.1	+	1.94002
			3.89506	Dist. 111′.4	=	2.04698
Prop. dif. lat.	87′.1	—	1.94002			
Dif. long.	90 .17	=	1.95504			
Mer. dif.	113 .0	—	2.05308			
Co. S. 38° 45′ E.	= tang.		9.90196			

Lat. ship	39° 10′ 51″ N.	M. P.	2544′.3	Long. ship	71° 42′ 58″ W.
" M. I.	18 02 43 N.	"	1094 .1	" M. I.	67 50 30 W.
Dif. 1268′.1 =	21 08 08 S.		1450 .2 S.	Dif. 232′.5 =	3 52 28 E.

Dif. long.	232′.5 E.		2.36642	Co. 9° 07′	sec.	.00552
Mer. dif.	1450 .2 S.		3.16137	Prop. dif. lat. 1268′.1		3.10312
Co. S. 9° 07′ E.	= tang.		9.20505	Dist. 1284′.	=	3.10864

TABLE OF DEVIATIONS.

Ship's Head	Dev.	Ship's Head	Dev.	Ship's Head	Dev.	Ship's Head	Dev.
N.	5° W.	N.	5° W.	S.	6° W.	S.	6° W.
N. by E.	2 W.	N. by W.	9 W.	S. by E.	3 E.	S. by W.	9 W.
N.N.E.	1 E.	N.N.W.	14 W.	S.S.E.	7 E.	S.S.W.	11 W.
N.E. by N.	6 E	N.W. by N.	17 W.	S.E. by S.	9 E.	S.W. by S.	17 W.
N.E.	10 E.	N.W.	22 W.	S.E.	10 E.	S.W.	21 W.
N.E. by E.	14 E.	N.W. by W.	25 W.	S.E. by E.	15 E.	S.W. by W.	23 W.
E.N.E.	20 E.	W.N.W.	27 W.	E.S.E.	20 E.	W.S.W.	25 W.
E. by N.	25 E.	W. by N.	29 W.	E. by S.	24 E.	W. by S.	28 W.
E.	22 E.	W.	30 W.	E.	22 E.	W.	30 W.

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To Allow for a Current.

As currents are found in all seas it becomes important to give them proper consideration; but in dealing with them it is well to remember that many influences tend to alter their location, drift and set. However the information shown by charts and found in the various sailing directions serve the purposes of the navigator to enable him to make a closely approximate allowance.

It is customary to do so on the chart, but this method does not give full satisfaction because the mile on the chart generally used is too small to make an accurate result possible. It then follows that a larger scale is necessary to obtain a satisfactory result. This is accomplished by placing a sheet of paper on the ordinary Mercator chart where it will be convenient to a compass rose and rule parallels and meridians over it for the purpose of preserving its position. Then with the parallel rules transfer the true or magnetic course as it may be to the paper and on that line measure off the speed of the ship per hour. As a scale one half inch may be used as a mile, but ten miles of longitude taken from the bottom or top of an ordinary Mercator chart will serve as a more convenient scale, as the miles becomes tenths, and it is always at hand.

Having the course on the paper, transfer the set of the current to the paper on the side of the course from which it comes, and on that line mark its drift per hour, using the same scale. Rule a line from the beginning of the course to that of the current and this line transferred to the compass rose will give the course to steer by compass to make good the course intended. With the same scale the distance to run by log to make the ship's speer per hour is measured. That distance divided by the ship's speed will give the distance to run by log to make good one mile. The whole distance between the two places multiplied by distance to run by log to make one mile will be the distance to run by log to make the distance good.

By the use of Pugsley's Current Course Projector the current course can be taken by simple inspection and by doing so the possibility of an error is eliminated.

By the following method the current course etc. can be calculated more accurately.

Construct a table and place the computed course and speed, and the set of the current reversed with its drift per hour. Both course and set of the current must be either true or magnetic. The resulting course will be true or magnetic according to the courses used.

Example: A ship is in latitude 35° 15′ *N.* and longitude 70° 56′ 45″ *W.*, wind *N.E.*, leeway ¾ point, variation 8° *W.* and a current setting *N.E.* by *E.* (magnetic) at the rate of 54 miles per day. The speed of the ship is 12 miles per hour.

Find the course to steer by compass and the distance to run by log to Scotland light-ship in latitude 40° 26′ 39″ *N.* and longitude 73° 55′ 10″ *W.* by Mercator sailing.

Lat. ship		35° 15′ 00″ N.		M. P.	2249′.1		Long. ship		70° 56′ 45″ W.	
" S. L. S.		40 26 39 N.		" "	2642 .9		" S. L. S.		73 55 10 W.	
Dif.	311′.65 =	5 11 39 N.		Dif.	393 .8 N.		Dif.	178′.4 =	2 58 25 W.	

Dif. long.	178′.4 W.	2.25139	Co. 24° 22′ 16″ sec.	.04054	
Mer. dif.	393 .8 N.	2.59528	Prop. dif. lat.	311′.65	2.49367
Co. N. 24° 22′ 16″ W. = tang.		9.65611	Dist.	342′.14 =	2.53421

Course	Speed	Current	Drift	N.	S.	E.	W.
N. 24° W.	12′	S. 48° W.	9′.25	10′.96	1′.51		4′.88 1 .67
				10 .96 1 .51	1 .51		6 .55
				9 .45			

Dif. lat.	9.45 N.	= Co. N. 35° W.	Dist. 11′.5	
Dep.	6.55 W.			
True Co.	N. 35° W.	12) 11.5 (.958		342′.14
Var.	— 8 W.	108		× 958
	N. 27 W.	70		273712
Leeway	— 8	60		171070
Com. Co.	N. 19 W.	100		307926
		96	Dist. =	327.77012
		4		

To make good the true course *N.* 24° *W.*, steer by compass *N.* 19° *W.*, and to make good the distance 342′.14 run by log 327′.8.

Example: The magnetic course is S.W. by W. Variation 6° E. Speed of the ship is 9′ per hour. The set of the current is N. 73° 30′ E. magnetic and its drift 72′ per day.

Find the proper course to steer by compass to make good the magnetic course S.W. by W. and the distance to run by log to make 98′ over the ground.

Course	Speed	Current	Drift	N.	S.	E.	W.
S. 56° W.	9′	S. 73° 30′ W.	3′		5.03 .85		7.46 2.88
					5.88		10.34

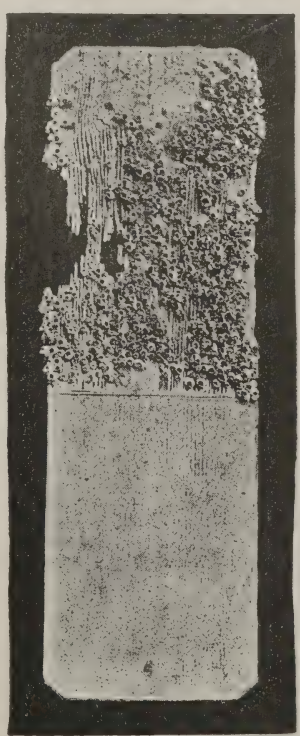
Dif. lat 5′.88 S. = Co. S. 60° W. Dist. 11′.9
Dep. 10 .34 W.

9) 11′.9 (1.32
9
29
27
20
18
2

98′.
× 1.32
1056
1188
Dist. = 129.36

To make good the magnetic course S.W. by W., steer by compass S. 60° W., and to make good the distance 98′ run by log 129′.4.

BACK LABEL IN JAPANESE.



Latitude by Meridian Altitude of the Sun.

Observe an altitude of the sun when on the meridian and correct it for instrumental error, semi-diameter, dip, refraction, and parallax. The result will be the true altitude, and must be subtracted from 90° to get the zenith distance which is named contrary to the sun's bearing.

Turn the longitude by account into time, and the result will be the Greenwich apparent time from noon.

From page 1 (of the month) in the nautical almanac take the sun's declination and multiply the hourly difference by the Greenwich apparent time from noon and the product will be the correction to be applied to declination as follows:

In west longitude, declination increasing, add; decreasing, subtract.

In east longitude, declination increasing, subtract; decreasing, add.

If the zenith distance and declination are of same name, add them together, and the result will be the latitude. If zenith distance and declination are of different name, subtract the lesser from the greater and the remainder will be the latitude, which takes the name of the greater.

Example: April 17, 1902. The observed meridian altitude of the sun's lower limb was 75° 12′ 20″ S. Longitude by account 67° 30′ W. Index correction 4′ 10″ +. Height of eye 45 feet.

Obs. alt. L. L.	75°	12′	20″	S.
I. C.	+	4	10	
	75	16	30	
Semi-diam.	+	15	57	
	75	32	27	
Dip	−	6	36	
	75	25	51	
Ref.	−		16	
	75	25	35	
Par.	+		02	
True alt.	75	25	37	
	90	00	00	
Zen. dist.		14	34	23 N.
Cor. dec.	+10	18	31	N.
Lat.	24	52	54	N.

Dec.	10°	14′	32″ N.
Cor.	+	3	59
Cor. dec.	10	18	31

H. D. 53″.02
Long. 67° 30′ W. = × 4h.5
26510
21208
3′ 59″ = 238″.590

Example: October 20, 1902. The observed meridian altitude of the sun's lower limb was 73° 11′ 14″ N. Longitude by account 16° 30′ E. Height of eye 40 feet.

Obs. alt. L. L.	73°	11′	14″	N.
Semi-diam.	+	16	05	
	73	27	19	
Dip	−	6	12	
	73	21	07	
Ref.	−		18	
	73	20	49	
Par.	+		02	
True alt.	73	20	51	
	90	00	00	
Zen. dist.		16	39	09 S.
Cor. dec.	+10	05	03	S.
Lat.	26	44	12	S.

Dec.	10°	06′	03″ S.
Cor.	−	1	00
Cor. dec.	10	05	03

H. D. 54″.15
Long. 16° 30′ = 1h.1
5411
5411
1′ 00″ = 59.521

Example: December 3, 1902. The observed meridian altitude of the sun's lower limb was 62° 09′ 06″ S. Longitude by account 52° 30′ E. Height of eye 39 feet.

Obs. alt. L. L.	62°	09′	06″	S.
Semi-diam.	+	16	15	
	62	25	21	
Dip	−	6	12	
	62	19	09	
Ref.	−		31	
	62	18	38	
Par.	+		04	
True alt.	62	18	42	
	90	00	00	
Zen. dist.		27	41	18 N
Cor. dec.	−21	59	41	S.
Lat.	5	41	37	N.

Dec.	22°	00′	58″ S.
Cor.	−	1	17
Cor. dec.	21	59	41

H. D. 21″.92
Long. 52° 30′ = × 3.5
10960
6576
1′ 17″ = 76.720

Example: March 21, 1902. The observed meridian altitude of the sun's lower limb was 56° 52′ 50″ N. Longitude by account 37° 30′ W. Height of eye 26 feet.

Obs. alt. L. L.	56°	52′	50″	N.
Semi-diam.	+	16	04	
	57	08	54	
Dip	−	5	00	
	57	03	54	
Ref.	−		38	
	57	03	16	
Par.	+		05	
True alt.	57	03	21	
	90	0		
Zen. dist.	32	56	39	S.
Cor. dec.	−	1	19	N.
Lat.	32	55	20	S.

Dec.	00°	01′	09″	S.
Cor.	−	2	28	
Cor. dec.		1	19	N.

H. D. 59″,22
Long. 37° 30′ W. = × 2 ..5
2′ 10
11844
2 28″ = 148.050

Chronometer Rate.

The importance of finding a new or verifying the rate of the chronometer has not received the attention it should have, as many opportunities to get that necessary information are neglected and sometimes result in discovering the error of the instrument when it is too late.

Explaining the first of the following examples a chronometer was delivered to a ship on September 8, 1901, with a rate paper stating that the instrument was slow 0m. 42s. and gaining daily 2s.9 daily. On November 16, 1901, an observation gave the local mean time 3h. 07m. 10s. P.M. with Mona Island light bearing true south. The longitude of the light being 67° 50′ 30″ W. and the chronometer showing 7h. 41m. 08s. P.M. The longitude in time applied to the local mean time gives the correct Greenwich mean time and the difference between that and the time shown by the chronometer at the instant of observation will be the error. The difference between the last error and that given on September 8, 1901, divided by the number of days will give the daily rate which in this case is found correct.

Example: On Sept. 8, 1901, a chronometer was delivered to a ship, and the rate paper showed the instrument to be slow 0m. 42s., and gaining daily 2s.9. On Nov. 16, 1901, an observation gave the local mean time 3h. 07m. 10s. P.M. with Mona Island light in longitude 67° 50′ 30″ time noted by chronometer was 0h. 01m. 56s. A.M.

L. M. T.	3h.	07m.	10s.	P.M.
Long.	4	31	22	
G. M. T.	7	38	32	P.M.
Chro.	7	41	08	P.M.
" fast		2	36	
Chro.	0h.	01m.	56s.	A.M.
Nov. 16 fast —		2	36	
	11	59	20	P.M.
Gained —		4	43	
G. M. T. Feb. 22d	11	54	37	P.M.

Sept.	22
Oct.	31
Nov.	16
Days	= 69
Nov.	14
Dec.	31
Jan.	31
Feb.	22.5
Days	= 98.5

Sept. 8 to Feb. 23 = days = 98.5
Rate daily × 2.87
6895
7880
1970
Gained 4m. 43s. = 282.695

Sept. 8 slow 0m. 42s.
Nov. 16 fast + 2 36
Gained 198s. = 3 18

69) 198 (2.87
138
600
552
480
483
3

Example: January 20, 1902. Time by chronometer 11h. 57m. 20s. A.M., and on November 8 was fast 2m. 51s., and on December 2 was fast 0m. 15s.

Chro.	11h.	57m.	20s.	A.M.
Dec. 2 fast	—		15	
	11	57	05	
Lost	+	5	18	
G. M. T.		02	23	P.M.

Nov.	22
Dec.	2
Days	= 24
Dec.	29
Jan.	20
Days	= 49

Dec. 2 to Jan. 20 = days = 49
Rathe daily × 6.5
245
294
Lost 5m. 18s. = 318.5

Nov. 8 fast 2m. 51s.
Dec. 2 " 15
Lost 156s. = 2 36

24) 156 (6.5
144
120
120

Example: June 11, 1902. Time by chronometer 0h. 35m. 04s. A.M., and on March 31 was fast 1m. 17s., and on May 20 was slow 0m. 38s.

Chro.		0h.	35m.	04s. A.M.
May 20 slow	+			38
		0	35	42
Lost	+			50
G. M. T.		0	36	32 A.M.

Apr.	30	March 31 fast	1m. 17s.
May	20	May 20 slow	+ 38
Days	= 50	Lost	115s. = 1 55

May	11
June	10.57
Days	= 21.57

50) 115 (2.3
100
150
150

May 20 to June 11 = days =	21.57
Rate daily	× 2.3
	6471
	4314
Lost	50s. = 49.611

Example: June 2, 1902. Time by chronometer 11h. 02m. 30s. P.M., and on January 26 was slow 1m. 08s., and on March 22 showed Greenwich mean time.

Chro.		11h.	02m.	30s. P.M.
March 31				0
		11	02	30
Gained	—		1	30
G. M. T.		11	01	00 P.M.

Jan.	5	Jan. 26 slow	1m. 08s.
Feb.	28	Mar. 22	0 0
Mar.	22	Gained	68s. = 1 08
Days	= 55		

55) 68 (1.24
55
130
110
200
220
20

Mar.	9
Apr.	30
May	31
June	2.46
Days	= 72.46

Mar. 22 to June 2 = days =	72.46
Rate daily	× 1.24
	28984
	14492
	7246
Gained	1m. 30s. = 89.8404

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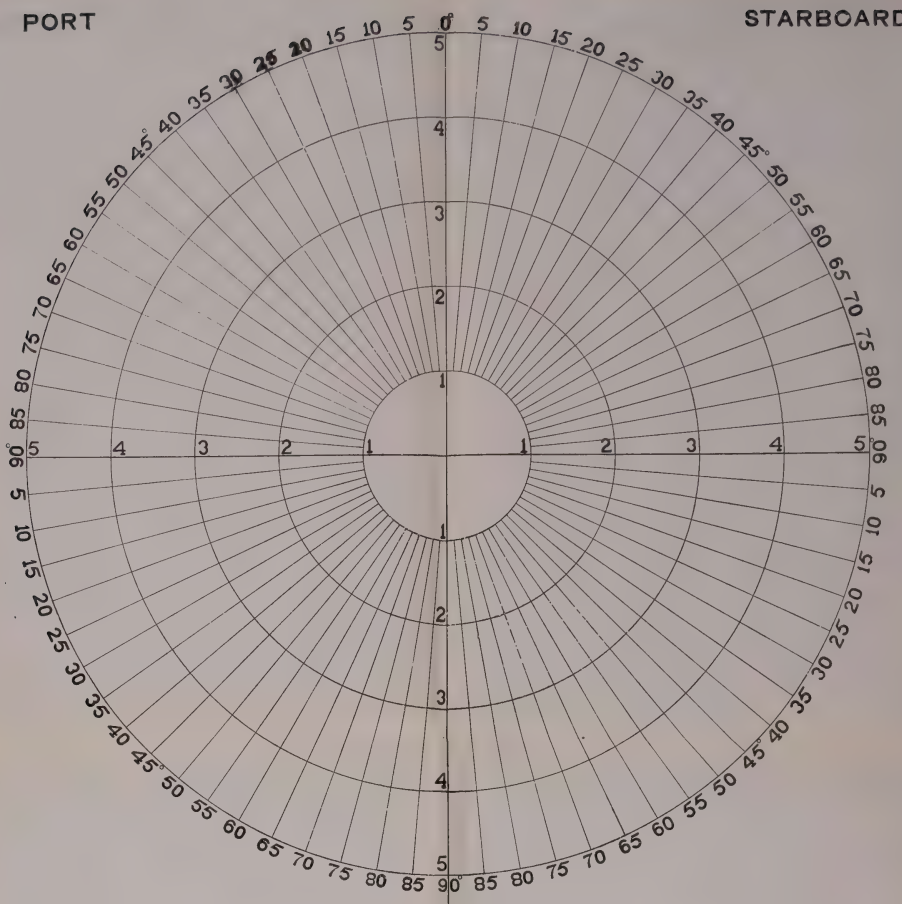


CAPT. R. M. PUGSLEY'S

Current-Course Projector.

The determination of the angle to be allowed for the effect of a current on a ship's course and distance has always been a matter of more or less difficulty and a great deal of guesswork, which have very rarely given satisfactory results.

Some navigators who have the necessary knowledge to project a current-course cannot deny that some considerable time and labor is required to perform the work, and therefore the method is not practicable under certain conditions. For instance, when a ship is sailing across a current which has a different velocity every few miles, such as the Gulf Stream between Key West and Cuba.

By the use of the CURRENT-COURSE PROJECTOR, such difficulties are entirely overcome because the desired result can be obtained by simple inspection at any time and as often as it may be required. The speed and course of the ship and the rate of the current and direction from which it comes is all that is required to obtain the necessary result in one or two minutes.

Instructions for the Use of Capt. R. M. Pugsley's Current-Course Projector.

Some navigators may prefer to count the degrees all on the bow and do away with the term—so many degrees abaft the beam in considering the current. If so the degrees may be so numbered with pen or pencil to suit the notion.

Currents.

A current is always named the same as a ship's course. That is, the course is named after the direction to which she sails. A current is named after the direction to which it sets or runs.

To use the current with this instrument, the direction from which it comes is to be considered.

1. Place the instrument on the chart table or any other convenient place.

2. Set the centre of the compass over the speed per hour of the ship.

3. Turn the compass card till the chart course is on the line marked SHIP'S SPEED PER HOUR.

4. Move the arm till its center line cuts the current at its rate and angle. The center line on the arm will then cut the course to steer by compass to counteract the effect of the current.

5. Note the number of miles on the arm at the intersection of the center line of the arm, with the rate and angle of the current, and it will be the distance to run by log to equal the speed of the ship. See the following examples.

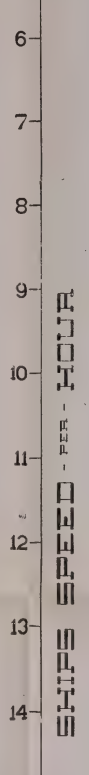
EXAMPLES.

The Current on the Starboard Bow.

Chart course is S. 5° W. The current sets N. 45° E., which is 40° on the starboard bow, at the rate of four knots per hour. The speed of the ship is fourteen knots per hour.

Find the course to steer by compass to make good the chart course and the distance to run by log to make good the ship's speed of fourteen knots.

Answer. Steer S. 14° W. by compass to make good the chart course S. 5° W. The distance to run by log to make good the ship's speed of fourteen knots per hour is 17½ miles.



The Current on the Port Bow.

Chart course is N. 20° E. The current sets S. 45° E., which is 65° on the port bow, at the rate of five knots per hour. The speed of the ship is eleven knots per hour.

Find the course to steer by compass to make good the chart course and the distance to run by log to make good the ship's speed of eleven knots per hour.

Answer. Steer N. 1° E. by compass to make good the chart course N. 20° E. The distance to run by log to make good the ship's speed per hour is nearly 14 miles.

The Current Abaft the Starboard Beam.

Chart course is W. The current sets S. 45° W., which is 45° aft of the starboard beam, at the rate of four knots per hour. The speed of the ship is twelve knots per hour.

Find the course to steer by compass to make good the chart course and the distance to run by log to make good the ship's speed of twelve knots per hour.

Answer. Steer N. 73° W. nearly by compass to make good the chart course and the distance to run by log to make good the ship's speed per hour is a little more than 9¼ miles.

The Current Abaft the Port Beam.

Chart course is S. 45° E. The current sets south, which is 45° abaft the port beam, at the rate of three knots per hour. The speed of the ship is seventeen knots per hour.

Find the course to steer by compass to make good the chart course and the distance to run by log to make good the ship's speed of seventeen knots per hour.

Answer. Steer S. 53° E. by compass to make good the chart course, and the distance to run by log to make good the ship's speed per hour is a little more than fifteen miles.

Note.

As the compass is not given here, a straight-edge properly graduated, and a protractor may be used. A smaller size of this instrument can be obtained complete of any dealer in nautical instruments.

CURRENT-COURSE PROJECTOR

BY

R. M. PUGSLEY

PUBLISHED
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STANDARD

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Longitude by Chronometer (Sun).

Observe an altitude not less than 12° when the sun is on or as near the prime vertical as possible, and note the time by a chronometer. Correct the altitude for instrumental error, semi-diameter, dip, refraction and parallax, and apply the error and rate of the chronometer to the time noted, and the result will be the Greenwich mean time of observation.

From the nautical almanac (page 2 of the month) take the sun's declination and hourly difference. If the Greenwich mean time is P. M., multiply the hourly difference by it, and the product will be the correction to be added to the declination if increasing; and subtracted if decreasing.

If the Greenwich mean time is A. M., it must be subtracted from twelve hours, which will give the time from noon, and with it multiply the hourly difference, and the product will be the correction to be subtracted from the declination, if increasing, and added if decreasing; and the result will be the correct declination.

Correct the equation of time by the same method used in correcting the declination.

Bring the latitude up by dead reckoning from the last observation to the time the altitude was observed.

If the latitude and declination are of the same name, subtract the declination from 90°. If the latitude and declination are of different name, add the declination to 90° and the result will be the polar distance.

From half the sum of the true altitude, latitude and polar distance, subtract the true altitude.

From table 44 take the log. secant of the latitude; log. cosecant of the polar distance; log. cosine of the half sum and log. sine of the remainder, and their half sum will be the log. sine of apparent time at ship when the observation was obtained. If the observation was taken in the morning, take this time from the A.M. column. If taken in the afternoon, take the time from the P.M. column. To this time apply the equation of time as directed (on page 1) in the nautical almanac, and the result will be the local mean time. The difference between this time and the Greenwich mean time, will be the longitude of the ship in time, and this is turned into degrees, etc., and is named by the following rule:

Greenwich time best, Longitude is west.

Greenwich time least, Longitude is east.

Example: February 8, 1902. A. M. The observed altitude of the sun's lower limb was 15° 10′ 00″. Time by chronometer 1h 28m 04s P.M., and fast 2m 06s. Latitude by account 19° 54′ N. Height of eye 26 feet.

Obs. alt. L. L.	15° 10′ 00″		Dec.	15° 11′ 28″ S.		H. D.	47″.14
Semi-diam.	+ 16 14		Cor.	− 1 06		G. M. T.	× 1.4
	15 26 14		Cor. dec.	15 10 22			18856
Dip	− 5 00			90 00 00			4714
	15 21 14		P. D	105 10 22			1′ 06″=65.996
Ref.	− 3 29						
	15 17 45						
Par.	+ 08						
True alt.	15 17 53						

Chro.	1h 28m 04s P. M.		E of T.	14m 21s.53		H. D.	0s.12
Fast.	− 2 06		Cor.	+ .17		G. M. T.	× 1.4
G. M. T.	1 25 58=1h.4		Cor. E. of T.	14 21.70			48
							12
							0s.17=168

Alt.	15° 17′ 53″		
Lat.	19 54 00	Sec.	.02674
P. D.	105 10 22	Cosec	.01541
	2)140 22 15		
½ sum	70 11 07	Cos.	9.53017
Alt.	15 17 53		
Rem.	54 53 14	Sin.	9.91276
			2)19.48508
App. time.	7h 31m 36s=Sin.		9.74254
Tab. cor.	− 03		
L. A. T.	7 31 33		5h = 75°
Eq. time.	+ 14 22		40m = 10
L. M. T	7 45 55 A. M.		08s = 00′ 45″
G. M. T.	1 25 58 P. M.		Long 85 00 45 W
Long.	5 40 03 W.		

Example: May 16, 1902. P. M. Longitude by account 19° 12′ W. The observed meridian altitude of the sun's lower limb was 58° 19′ 20″ N. The ship then sailed 28 miles S. 86° W. Variation 21° W. Deviation 6° E. The observed altitude of the sun's lower limb was then 10° 50′. Time by chronometer 6h 09m 06s P. M. The sun's bearing by compass was S. 127° 30′ W. I. C. 4′30″—. Height of eye 40 feet. Find latitude and longitude at time of both observations, and the deviation of the compass.

Obs. mer. alt. L. L.	58°	19′	20″ N.
I. C.	—	4	30
	58	14	50
Semi-diam.	+	15	50
	58	30	40
Dip	—	6	12
	58	24	28
Ref.	—		36
	58	23	52
Par.	+		04
True alt.	58	23	56
	90	00	00
Zen. dist.	31	36	04 S.
Cor. dec.	—18	57	27 N.
Lat. at noon.	12	38	37 S.
Diff. lat.	+	9	06 S.
Lat. P. M. obs.	12	47	43 S.

Dec.	18°	56′	41″ N.
Cor.	+		46
Cor. dec.	18	57	27 N.

H. D. 35″.16
Long. 19° 12′ = ×1h.3
10548
3516
46″ = 45.708

Compass Course.	Var.	Dev.	Cor. Course.	Dist.	Diff. lat. N.	Diff. lat. S.	Dep. E.	Dep. W.
S. 86° W.	21° W.	6° E.	S. 71° W.	28		9.1	26.5	

Obs. alt. L. L.	10°	50′	00″
I. C.	—	4	30
	10	45	30
Semi-diam.	+	15	50
	11	01	20
Dip	—	6	12
	10	55	08
Ref.	—	4	51
	10	50	17
Par.	+		09
True alt.	10	50	26

Dec.	18°	56′	43″ N.
Cor.	+	3	38
Cor. dec.	19	00	21
	90	00	00
P. D.	109	00	21

H. D. 35″.16
G. M. T. = × 6h.2
7032
21096
3′ 38″ = 217.992

E. of T. 3m 48s.52
Cor. 00 .14
Cor. E. of T. 3 48 .38

H. D. 0s.023
G. M. T. × 6h.2
046
138
0s.14—426

Alt.	10°	50′	26″
Lat.	12	47	43
P. D.	109	00	21
	2)132	38	30
½ sum	66	19	15
Alt.	10	50	26
Rem.	55	28	49

Sec. .01092
Cosec. .02435
Cos. 9.60381
Sin. 9.91589
2)19.55497
Sin. 9.77748

	4h	54m	24s	P. M.
Tab. cor.	+			02
L. A. T.	4	54		26
Eq. time	—	3		48
L. M. T.	4	50		38 P. M.
G. M. T.	6	09		06 P. M.
Long.	1	18		28 W.

1h = 15°
18m = 4 30′
28s. = 7 00″

Long. P. M. 19 37 00 W.
Diff. long. — 27 E.
Long. noon. 19 10 00 W.

P. D.	109°	00′	21″
Lat.	12	47	41
Alt.	10	50	26
	2)132	38	28
½ sum	66	19	14
P. D.	109	00	21
Diff.	42	41	07

½ true az. 56° 16′

Sec. .01093
Sec. .00781
Cos. 9.60388
Cos. 9.86635
2)19.48897
Cos. 9.74448

½ true az. 56° 16′
× 2
True az. S. 112 32 W.
Com. az. S. 127 30 W.
Com. error 14 58 W.
Var. — 21 00 W.
Dev. 6 02 E.

Yacht Specialties

"New Jersey"

Yacht Red Copper Paint,
Yacht Green Copper Paint,
Yacht White and Black Paint.

Example: March 17, 1902, A. M. The observed altitude of the sun's lower limb was 18° 17′ 20″. Time by chronometer 11h 11m 21s A. M., and was slow 56h 46s. After taking this observation, the ship sailed N. 17° E., var. 6° W., dev. 12c E., a distance of 28 miles, and then the observed meridian altitude of the sun's lower limb was 59° 48′ 10″ S. Longitude by account 67° 46′ W. I. C.—6′ 40″. Height of eye 38 feet. Find the altitude and longitude at the time of both observations.

Chro.		11h	11m	21s	A. M.
Slow	+		56	46	
G. M. T.		00	08	07	P. M.

Obs. alt.		18°	17′	20″	Dec.	1°	36′	05″ S.	H. D.	59″.25
I. C.	−		6	40	Cor.	−		06	G. M. T.	×0h.1
		18	10	40	Cor. dec.	1	35	59	Cor. 6″	− 5.925
Cor.	+		6	57		90	00	00 N.		
True alt.		18	17	37	P. D.	91	35	59		

Eqa. of time		8m	43s	.12	H. D.		0s.728
Cor.	−			.07	G. M. T.		×0h.1
Cor. eqa. time		8	43	.05	Cor.	0s.07	− .0728

Obs mer. alt.		59°	48′	10″ S.	Dec.	1°	35′	56″ S.	H. D.	59″.22
I. C.	−		6	40	Cor.	−	4	26	Long. 67° 46′ W.	−×4h.5
		59	41	30	Cor. dec.	1	31	30		29610
Cor.	+		9	22						23688
True alt.		59	50	52					Cor. 4′ 26″	− 266.490
		90	00	00						
Zen. dist.		30	09	08 N.						
Cor. dec.		− 1	31	30 S.						
Lat. noon.		28	37	38 N.						
Diff. lat.		−	25	48 S.						
Lat. A. M. obs.		28	11	50 N.						

Com. Course.	Var.	Dev.	Cor Course.	D'st.	Diff. lat.		Dep.	
					N.	S.	E.	W.
N. 17° E.	6° W.	12° E.	N. 23° E.	28′	25′.8		10′.9	

Lat. A. M.	28°	12′	N.
Lat. noon.	28	37	N.
	2)56	49	
Mid. lat.	28	24	— 28° Dep 10′.9 E.—diff. long. 12′.3 E.

Alt.		18°	17′	37′				
Lat.		28	11	50′	Sec.		.05487	
P. D.		91	35	59	Cosec.		.00017	
	2)	138	05	26				
½ sum		69	02	43	Cosin.		9.55343	
Alt.	−	18	17	37				
Rem.		50	45	06	Sin.		9.88897	
							2)19.49744	
		7h	27m	12s =	Sin.		9.74872	

Tab. cor.				02	4h	= 60°		
L. A. T.		7	27	10 A. M.	32m	= 8	00′	
Eq. time	+		8	43	14s	=	3	30″
L. M. T.		7	35	53 A. M.	Long. A. M. obs.	68	03	30 W.
G. M. T.		00	08	07 P. M.	Diff. long.	−	12	18 E.
Long. A. M. obs.		4	32	14 W.	Long. noon.	67	51	12 W.

Top and Bottom Paint for everything that floats. Highest medals and best testimonials for all the marine productions from

NEW JERSEY PAINT WORKS

HARRY LOUDERBOUGH, Inc., Jersey City, N. J.

Example: March 21, 1902, A. M. The observed altitude of the sun's lower limb was 85° 17′ 30″. Time by chronometer 1h 20m 30s P. M., and fast 3m 00s. Latitude by account 00° 00′ 00″. Height of eye 40 feet.

Obs. alt. L. L.	85°	17′	30″
Semi-diam.	+	16	04
	85	33	34
Dip	−	6	12
	85	27	22
Ref.	−	1	22
	85	26	00
Par.	+		07
True alt.	85	26	07

Chro.	1h	20m	30s P. M.
Fast.	−	3	00
G. M. T.	1	17	30 P. M

Dec.	00°	01′	16″N.
Cor.	−	1	16
Cor. dec.	00	00	00
	90	00	00
P. D.	90	00	00

E. of T.	7m	32s	.09
Cor.	−		.97
Cor. E. of T.	7	31	.12

H. D.	59″.23
G. M. T.	= ×1h.29
	53307
	11846
	5923
1′ 16″	= 76.4067

H. D.	0s.754
G. M. T.	×1h.29
	6786
	1508
	754
	.97266

Alt.	35°	26′	07″
Lat.	00	00	00
P. D.	90	00	00
	2)125	26	07
½ sum	62	43	03
Alt.	35	26	07
Rem.	27	16	56

Sec.	.00000
Cosec.	.00000
Cos.	9.66123
Sin.	9.66123
	2)19.32246
Sin.	9.66123

L. A. T.		8h	21m	44s
Eq. time	+		7	31
L. M. T.		8	29	15 A. M.
G. M. T.		1	17	30 P. M.
Long.		4	48	15 W.

	4h	=	60°
	48m	=	12 00′
	15s	=	3 45″
Long.	72	03	45 W.

To find the longitude by the above observation, it is only necessary to correct the altitude and subtract it from 90° and the result will be the hour angle in degrees, etc. This turned into time will be the local apparent time if observation is P. M. If A. M., subtract from 12h 00m 00s and the result will be the local apparent time. Apply the equation of time and proceed to find the longitude.

True alt.	35°	26′	07″ E.
	90	00	00
Zen. dist.	54	33	53

4h	=	60°	
48m	=	12	00′
15s	=	3	45″
Long.	72	03	45 W

54°	=	3h	36m
33′	=		2 12s
53″	=		4
H. A.		3	38 16
		12	00 00
L. A. T.		8	21 44
Eq. time	+		7 31
L. M. T.		8	29 15 A. M.
G. M T.		1	17 30 P. M.
Long.		4	48 15 W.

DON'T FAIL

To examine our Two Century Calendar in the back of this book, which runs from 1801 to 2003; it is very cleverly constructed and is copyrighted.

"New Jersey" Marine Paints

Are bargains to the consumers; a bargain does not consist of what you pay but what you get.

The following example shows that it does not matter which polar distance is used when the observation is taken on the equator.

Example: June 16, 1902, P. M. The observed altitude of the sun's lower limb was 21° 17′ 20″. Greenwich mean time 10h 10m 35s P. M. Latitude 00° 00′ 00″. Dip 35 feet.

USING SOUTH POLAR DISTANCE.

Obs. alt. L. L.	21°	17′	20″	Dec.	23°	19′	50″N.	H. D.		6″.08
Semi.-diam.	+	15	46	Cor.	+	1	02	G. M. T.		×10.2
	21	33	06	Cor dec	23	20	52			1216
Dip	−	5	48		90	00	00			608
	21	27	18	P. D.	113	20	52		1 02″	− 62″.016
Ref.	−	2	27							
	21	24	51							
Par.	+		8	E. of T.		0m 15s	.50	H. D.		0s.528
True alt.	21	24	59	Cor.	+	5	.38	G. M. T.		×10.2
				Cor. E of T.	0	20	.88			1056
										528
										−5.3856

Alt.	21°	24′	59″			
Lat.	00	00	00	Sec.	.00000	
P. D.	113	20	52	Cosec.	.03710	
	2)134	45	51			
½ sum	67	22	55	Cos.	9.58499	
Alt.	21	24	59			
Rem.	45	57	56	Sin.	9.85668	
					2)19.47877	
		4h	26m 16	= Sin.	9.73938	
Tab.cor.	−		02			
L. A. T.		4	26 14			
Eq. time	+		21		5h = 75°	
L. M. T.		4	26 35 P. M.		44m = 11 00′	
G. M. T.		10	10 35 P. M.		Long. 86 00 W.	
Long.		5	44 00 W.			

USING NORTH POLAR DISTANCE.

Alt.	21°	24′	59″					Cor. dec.	23°	20′ 52″N.
Lat.	00	00	00	Sec.	.00000				90	00 00
P. D.	66	39	08	Cosec.	.03710			P. D	66	39 08
	2)88	04	07							
½ sum	44	02	03	Cos.	9.85668					
Alt.	21	24	59							
Rem.	22	37	04	Sin.	9.58499					
					2)19.47877					
		4h	26m 16	= Sin.	9.73938					
Tab. cor.	+		02							
L. A. T.		4	26 14							
Eq. time	+		21		5h =	75°				
L. M. T.		4	26 35 P. M.		44m =	11 00′				
G. M. T.		10	10 35 P. M.		Long.	86 00 W.				
Long.		5	44 00 W.							

"New Jersey" Copper Paints

are not cheap, but just right in price to be right in quality. We value the reputation of our goods more than we do our entire plant; reputation may bring the first order, but quality must bring the succeeding ones.

Longitude by Sunset and Sunrise.

With the naked eye, a piece of colored glass or a telescope, observe the sun's limb to touch the horizon and note the time by chronometer, and apply its rate to the time noted. In this observation, the altitude is a negative quantity and is found by adding the dip to the refraction for 0° altitude and to the result add the semi-diameter and subtract parallax if the upper limb is observed; but subtract the semi-diameter and parallax if the lower limb is observed. From the sum of the latitude by account and the polar distance subtract the negative altitude, divide the result by two, which will give the half sum, and to it add the negative altitude to get the remainder. From here this calculation is the same as any chronometer sight of the sun.

Example: March 10, 1902. The sun's lower limb was observed on the horizon at setting. Time by chronometer 10h 40m 49s P. M. Latitude by account 35° 17′ N. Height of eye 40 feet.

Ref. alt. 0°		36′	29″	Dec.	4°	21′	24″ S.	H. D.		58″.7
Dip		+ 6	12	Cor.	—	10	28	G. M. T.		× 10 .7
		42	41	Cor. dec.	4	10	56			4109
Semi-diam.		−16	07		90	00	00			587
		26	34	P. D.	94	10	56		10′ 28′ —	628.09
Par.		—	9							
Neg. alt.		26	25	Equ. of time		10m.	37s.98	H. D.		0s.638
				Cor.		—	6 .83	G. M. T.		× 10 .7
				Cor. E. of time		10	31 .15			4466
										638
									6s.83 —	6.8266

Lat.	35°	17′	00″	Sec.	.06815				
P. D.	94	10	56	Cosec.	.00116				
	129	27	56						
Neg. alt.	—	26	25						
	2)129	01	31						
½ sum	64	30	45	Cos.	9.63378				
Neg. alt.	+	26	25						
Rem.	64	57	10	Sin.	9.95711				
					2)19.68020				
App. time		5h.	50m.	16s. — Sin.	9.84010				
Tab. cor.		+		2					
L. A. T.		5	50	18					
Eq. time		+	10	31					
L. M. T.		6	00	49 P. M.	4h	— 60°	00′		
G. M. T.		10	40	49 P. M.	40m	— 10	00	00″	
Long.		4	40	00 W.	Long.	70	00	00 W.	

Example: March 8, 1902. The sun's upper limb was observed on the horizon at setting. Time by chronometer 10h 56m 31s P. M., and slow 3m 15s. Latitude by account 37° 15′ 00″ N. Height of eye 40 feet.

Ref. alt.	0°	36′	29′	Dec.	5°	08′	14′.9 S.	H. D.		53′.39
Dip		+ 6	12	Cor.	—	10	42 .3	G. M. T.		× 11h
		42	41	Cor. dec.	4	57	32 .6 S.			5839
Semi. diam.		+ 16	08		90	00	00 0			5839
		58	49	P. D.	94	57	32 .6		Cor. 10′ 42′.3	= 642′.29
Par.		—	09							
Neg. alt.		58	40							

Chro. time	10h	56m	31s P. M.	Equ. of time		11m.	07s.88	H. D.	0s.607
Slow +		3	15	Cor.		—	6.68	G. M. T.	× 11h
G. M. T.	10	59	46 P. M.	Cor. equ. of time		11	01.20		607
									607
								Cor. 6s.68	= 6s.677

Lat.	37°	15′	00″	Sec.	.09909					
P. D.	94	57	33	Cosec.	.00163					
	182	12	33							
Neg. alt.	—	58	40							
	2)131	13	53							
	65	36	56	Cos.	9.61580					
Neg. alt.	+	58	40							
Rem.	66	35	36	Sin.	9.96270					
					2)19.67922					
		5h	49m	52s = Sin.	9 83961					
Tab. cor.		—		03						
L. A. T.		5	49	49 P. M.						
Equ. of time		+	11	01		4h	= 60°			
L. M. T.		6	00	50 P. M.		58m.	= 14	30′		
G. M. T.		10	59	46 P. M.		56s.	=	14	00′	
Long.		4	58	56 W.		Long.	74	44	00 W.	

Example: November 27, 1902. The sun's upper limb was observed on the horizon at rising. Time by chronometer 6h 08m 16s A. M., and slow 8m 14s. Height of eye 30 feet. Latitude by account 30° 30′ 30″ S. Find the longitude at time of observation, and from that position find the course and distance to Cape of Good Hope light by Mercator and middle latitude sailing.

Ref. alt. 0°			36′	29″	Dec.	21°	00′	58″ S.	H. D.	28″.06
Dip			5	22	Cor.	—	2	40	H. A.	= × 5h.7
Semi. diam.	+		16	14	Cor. due.	20	58	18 S.		19642
			58	05		90	00	00		14080
Par.	—			09	P. D.	69	01	42	Cor. 2′ 40″ =	159.942
Neg. alt.			57	56						

Chro. time		6h	08m	16s A. M.	Exu. of time		12m	30s.32	H. D.	0s.807
" slow	+		8	14	Cor.	+		4.60	H. A.	= × 5h.7
G. M. T.		6	16	30	Cor. E. of time	=	12	34.92		5649
		12	00	00						4035
H. A. 5h.7	=	5	43	30					Cor. 4s.60 =	4.5999

Lat.		30°	30′	30″	Sec	.06472
P. D.		69	01	42	Cosec.	.02977
		99	32	12		
Neg. alt.	—		57	56		
	2)	98	34	16		
½ sum		49	17	08	Cos.	9.81444
Neg. alt.	+		57	56		
Rem.		50	15	04	Sin.	9.88585
						2)19.79478
		5h	02m	48s	= Sin.	9.89739
Tab. cor.	+			08		
L. A. T.		5	02	51 A. M.	1h	= 15°
Eq. time	—		12	35	26m	= 6 30′
L. M. T.		4	50	16 A. M.	14s	= 3 30″
G. M. T.		6	16	30 A. M.		
Long.		1	26	14 W.	Long.	= 21 33 30 W.

MERCATOR SAILING

Lat. Ship		30°	30′	30″ S.	Mer. parts		1911.8		Long. ship	21°	33′	30″ W.
" C. G. H. L.		34	21	12 S.	" "		2183.9		" C. G. H. L.	18	29	26 E.
Diff. lat. 230′.7	=	3	50	42 S.	Mer. diff. lat.	=	272,1 S.		Diff. long. 2402′.9	= 40	02	56 E.

Diff. long.	2402′.9 E.	log.	3.38073	Prop. diff. lat. 230′.7	log. 2.36305
Mer. diff. lat.	272′.1 S,	"	2.43473	Course S. 83° 32′ E.	cos. 9.05164
Course S. 83°	32′ E.	= tang.	.94600	Distance 2048′.4	= log. 3.31141

MIDDLE LATITUDE SAILING.

Lat. ship		30°	30′	30″	Diff. long.	2402′.9 E.	log.	3.38073	Course S. 83° 32′ E.	sec. .94836
" C. G. H. L.		34	21	12	Mid. lat. 32° 05′ 51″		cos.	9.92835	Prop. diff. lat. 230′.7	log. 2.36305
		2)64	51	42	Dep. 2037′.4		= log.	3.30908	Distance 2048′.4	= " 3.31141
Mean lat.	=	32	25	51	Prop. diff. lat. 230′.7 S.		"	2.36305		
Correction	—		25	00	Course S. 83° 32′ E.		= tang.	.94603		
Mid. lat.	=	32	00	51						

Norfolk, Va., Oct. 10, 1901.

Mr. H. Louderbough.

Dear Sir.—After a trial of many years at our Shipyard and Railways at Norfolk, Va., your "New Jersey" Copper Paint has stood the test of many trials, and proved itself to be the best Anti-Fouling Paint ever used in the waters of our bay, and for years I have only carried your brand in stock, and many patrons that I have induced to try it, all express themselves as being well pleased with the results of such trials.

CHAS. J. COLONNA.

Jersey City, N. J., Nov. 14, 1901.

Mr. H. Louderbough.

Dear Sir.—Your Red Copper Paint is very popular with both yachtsmen and fishermen; we have applied a large quantity at our yard with satisfaction to all. Your New Jersey Brown Copper is also a favorite with schooner captains. Very truly yours,

DOWNING & LAWRENCE DRY DOCK CO.

Perth Amboy, N. J., Nov. 25, 1901.

At our Dry Docks we have been for years large users of your New Jersey brands of Copper Paint, Mixed Paints, Seam Paint and Perfect Ship Black, and our consumption of these Paints shows plainly our appreciation and that of our customers for your productions of Paints. We remain, yours truly,

PERTH AMBOY DRY DOCK CO.

Norfolk, Va., Oct. 20, 1901.

Mr. H. Louderbough.

Dear Sir.—In our Ship Chandlery business, at this port, we have handled several copper paints, but in recent years, through the great demand we received for your "New Jersey" Copper Paint, we have given up all other brands, and now only sell your brand of Paint. Endorsements of its quality are frequently given in by those who have given it repeated trials. In our experience of ten (10) years, we have never had a can returned with complaint.

Yours truly, J. M. JORDAN & CO.

Example: May 19, 1902. The sun's lower limb was observed on the horizon at setting and bore by compass W. ½ S. Time by chronometer was 10h. 04m. 07s. A.M., and on April 22 was fast 7m. 14s. and losing 2s.3 daily. Latitude by account 36° 54′ 15″ S. Height of eye 36 feet. Variation 14° 30′ E.

Find the longitude in and the course and distance by Mercator sailing to point in latitude 19° 52′ 36″ S. and longitude 57° 39′ 08″ E. Also the deviation of the compass.

Chro.		10h.	04m.	07s.	A.M.		Apr.	8	d.	Rate	2.3
Fast	—		7	14			May	18.9		Days	26.9
		9	56	53				26.9			807
Lost	+		1	2							538
G. M. T.		9	57	55	A.M.	= 2h.				Lost 1m. 02s.	= 61.87
Ref. — Par.		—	36′	20″			Dec.	19°	37′ 27″ N.	H. D.	32″.71
Dip		—	5	53			Cor.	—	1 05	H. A.	× 2
		—	42	13			Cor. dec.	19	36 22	Cor. 1′ 05″	= 65.42
S. D. L. L.		+	15	49				90			
Neg. alt.		—	26	24			P. D.	109	36 22		
							Eq. Time		3m. 44s.41	H. D.	.092
							Cor.	+	′0 .18	H. A.	× 2
							Cor. Eq. Time		3 44 .59	Cor. 0s.19	= .184
Lat.			36°	54′	15″		Sec.		.09710		
P. D.			109	36	22		Cosec.		.02594		
			146	30	37						
Alt.		—		26	24						
		2)	146	04	13						
½ sum			73	02	06		Cos.		9.46507		
Alt.		+		26	24		Sin.		9.98168		
Rem.			73	28	30			2)	19.56979		

L. A. T.		5h.	00m.	22s.	P.M.	= Sin.		9.78489		
Eq. T.	—		3	45			6h.	=	90°	
L. M. T.		4	56	37	P.M.		58m.	=	14 30′	
G. M. T.		9	57	55	A.M.		42s.	=	10 30″	
Long.		6	58	42	E.		Long.		104 40 30	E.

Lat.		36° 54′		Sec.	.09708	
Dec.		19 36		Sin.	9.52563	
True amp.	W.	24° 48′ N.	=	Sin.	9.62271	
Com. "	W.	5 37 S.				
" error		30 25 E.				
Var.		14 30 E.				
Dev.		15 55 E.				

Lat. ship		36°	54′	15″	S.		M. P.	2371.1		Long. ship	104° 40′ 30″ E.
" point		19	52	36	S.		"	1209.7		" point	57 39 08 E.
Dif. 1021.6	=	17	01	39	N.			1161.4		Dif. 2821′.4	= 47 01 22 W.
Dif. long. 2821′.4						3.45040				Co. 67° 38′ sec.	.41961
Mer. dif. lat. 1161.4						3.06483				Prop. dif. lat. 1021.6	3.00945
Co. N. 67° 38′ W. = tang.						0.38557				Dist. 2686′	= 3.42906

NOTICE TO THE MARINE TRADE.

The manufacturing business formerly conducted by R. F. SEAMAN, at 130 & 132 Bay Street Jersey City, N. J., consisting of the following brands of Marine Paint:

"AMERICAN IRON CROWN" PAINTS, No. 1 and No. 2,
For the Bottoms of Iron and Steel Vessels.

WETTERSTEDT'S COPPER PAINT,
Under Patents in England, France and United States.

SEAMAN'S SEAM PAINT.

Having purchased the business, trade-marks, good will, stock, fixtures, and everything pertaining to the business, which productions will be continued to be manufactured under the above brands by me as his successor.

HARRY LOUDERBOUGH, Inc.

NEW JERSEY PAINT WORKS

Cor. WAYNE AND FREMONT STS. JERSEY CITY, N. J., U. S. A.

Example: August 8, 1902. The sun's upper limb was observed on the horizon at rising. Time by chronometer 10h. 50m. 14s. A.M. and fast 7m. 19s. Latitude by account 20° 27′ 30″ N. Height of eye 36 feet.

Chro.		10h.	50m.	14s.	A.M.						
Fast	—		7	19							
G. M. T.		10	42	55	A.M.	=	1h.3				
Ref. — Par.	—	36′	20″								
Dip.	—	5	53								
S. D. U. L.	—	15	48								
Neg. alt.	—	58	01								

Dec.	16°	20′	51″	N.	
Cor.	+		55		
Cor. dec.		16	21	46	
		90			
P. D.		73	38	14	
Eq. Time		5m.	34s.38		
Cor.	+		.39		
Cor. Eq. Time		5	34 .77		

H. D.			42″.16
H. A.			× 1.3
			12648
			4216
Cor.	55″	=	54.808
H. D.			0s.301
H. A.			× 1.3
			903
			301
Cor.	0s.39	=	.3913

Neg. alt.		00°	58′	01″			
Lat.		20	27	30		Sec.	.02829
P. D.		73	38	14		Cosec.	.01795
		2)95	03	45			
½ sum		47	31	52		Sin.	9.86785
Neg. alt.	—		58	01			
Rem.		46	33	51		Cos.	9.83730
							2)19.75139
L. A. T.		5h.	30m.	31s.	A.M. =	Sin.	9.87569
Eq. T.	+		5	35			
L. M. T.		5	36	06	A.M.		
G. M. T.		10	42	55	A.M.		
Long.		5	06	49	W.		

5h.	=	75°	
6m.	=	1	30′
49s.	=		12 15″
Long.		76	42 15 W.

In this problem the altitude is used in the usual way, the logarithm sine is taken for the half sum and logarithm cosine for the remainder which gives exactly the same result.

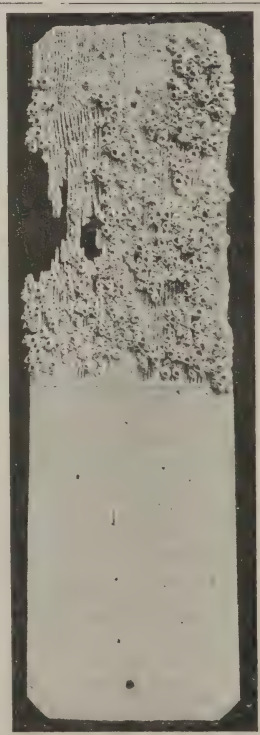
PINTURAS DE COBRE

UN CASO NOTABLE

EL grabado es copia de la fotografía de un trozo de madera del cual uno de los extremos fué pintado con la **PINTURA DE COBRE DE LA CIUDAD DE JERSEY,** manufacturada por Harry Louderbough, propietario de la FABRICA DE PINTURAS DE NEW JERSEY, en la ciudad de Jersey, N. J., y conservado en el agua por espacio de cinco meses en Port Royal, S. C. Sobre el extremo sin pintura se ven los estragos causados por el gusano de agua salada, tan destructivo para la madera, y el gran número de caracoles á ella adheridos. Obsérvese el extremo pintado con la **PINTURA DE COBRE DE NEW JERSEY** y su espléndida condición.

Este trozo de madera fué puesto por mi en el agua en Port Royal, S. C., por espacio de cinco meses. Después de ese tiempo el extremo pintado salió tan limpio como antes de sumergirse.

MILLS EDWARD,
Cap. del pailebot "Florence Shay."



Trade Mark, Reg. U. S. Pat. Off. No. 54,432

BACK LABEL IN SPANISH.

DE "NEW JERSEY."

ESPECIALIDADES

DE NUESTRAS

PINTURAS PARA MARINA

NEW JERSEY

- PINTURA de COBRE.
- PINTURA roja de COBRE para yats.
- PINTURA ELASTICA para calafate
- NEGRA para YATS.
- BLANCA para YATS.
- PINTURA para mastiles.
- PINTURA para chimeneas.
- PINTURA para cascos y cubiertas.

El Instituto Americano de Nueva York acordo a nuestra New Jersey Pintura de cobre, Pintura para calafate y Pintura preservativa para pilotes, una medalla, el premio mas elevado que fué concedido.

THE BEST IS THE CHEAPEST.
NEW JERSEY MIXED PAINTS
LEAD THEM ALL
AS IT IS STRICTLY A PURE LINSEED OIL PAINT.
QUALITY GUARANTEED
MANUFACTURED FROM BEST PIGMENTS
YACHT BLACK
AND DOES NOT CONTAIN ANY WATER, BENZINE OR CHEMICALS.
NEW JERSEY PAINT WORKS
JERSEY CITY, N.J. U.S.A.
HARRY LOUDERBOUGH, PROPRIETOR.

Longitude and Latitude by Equal Altitudes.

Example: April 29, 1902. In latitude 31° 18′ 30″ N. by account, the following equal altitudes of the sun's lower limb were observed. A. M. altitude 72° 47′ S., and time by chronometer 4h 14m 10s P. M. P. M. altitude 72° 47′ S., and time by chronometer 4h 27m 06s P. M. Height of eye 37 feet.

(LONGITUDE.)

Chro. A. M. obs.	4h.	14m.	10s.	P. M.
" P. M. "	4	27	06	P. M.
	2) 8	41	16	
Mid. chro. time	4	20	38	
Eq. of time	+	2	99	
Long.	4	83	17	W.

Eq. T.	2m.	37s.12	
Cor.	+	1 .60	
Cor. Eq. T.	2	38 .72	
4h. =	60°		
23m. =	5	45′	
17s. =		4	15″
Long.	65	49	15 W.

H. D.	0s.373
G. M. T. =	×4.3
	1119
	1492
	1.6039

(LATITUDE.)

Obs. alt. L. L.	72°	47′	00″	S.
Semi-diam.	+	15	54	
	73	02	54	
Dip	−	05	48	
	72	57	06	
Ref.			18	
	72	56	48	
Par.	+		2	
	72	56	50	
Cor.	+	3	56	
True mer. alt.	73	00	46	
	90	00	00	
Zen. dist.	16	59	14	N.
Cor. dec.	14	18	51	N.
Lat.	31	18	05	N.

Dec.	14°	15′	20″ N.
Cor.	+	3	31
Cor. dec.	14	18	51

H. D.	46.″98
G. M. T.	× 4.5
	23490
	18792
3′ 31″ =	211.410

Chro. A. M. obs.	4h.	14m.	10s.
" P. M. "	4	27	06
Diff.	2) 0	12	56
H. A. 6m.5 =		6	28

H. A.	6m. 5² =	42.2
Table 26		× 5 6
		2532
		2110
Cor.	3′ 56″ =	236″ .32

That part of this calculation by which the latitude is found, is commonly known as ex-meridian.

Latitude by Ex-Meridian Altitudes.

By this method, the latitude may be obtained when on account of cloudy weather the meridian altitude cannot be observed, as is often the case. While there are a number of tables published for the solution of this calculation, experience has proven that none are so reliable, simple, and convenient for the use of the navigator as that given here from Bowditch. Some of the others are more or less complicated and can only be used by those who use them very frequently, and navigators should in all cases select the most simple and convenient correct methods for the determination of latitude, longitude, etc.

The altitude is observed as near noon as possible; but good results may be obtained as much as thirty or forty minutes from noon. It is important that the hour angle should be computed accurately, or as nearly so as possible. This depends somewhat on the degree of certainty of the longitude and more particularly so when the hour angle is great. When the altitude is observed, note the time by chronometer and to it apply the error and rate, if any, and the result will be the Greenwich mean time, and with it correct the declination and equation of time as usual. Apply the equation of time to the Greenwich mean time to obtain the Greenwich apparent time, and to this apply the longitude to obtain the local apparent time. If that time is over twelve hours, subtract twelve hours from it and the remainder will be the hour angle. If the local time is less than twelve hours, subtract it from twelve hours to obtain the hour angle. The seconds of the hour angle must be reduced to at least one decimal place. The hour angle is then squared, which means that it is to be multiplied by itself. As an example: Suppose the hour angle to be 3m. Then $3 \times 3 = 9$, which would be the hour angle square. If the hour angle is less than thirteen minutes, its square may be obtained from table 27. If the new edition of Bowditch is used, table 27 will be found to contain the square of the hour angle to twenty-six minutes, multiplied by the numbers from table 26.

The hour angle having been found and squared, altitude and declination corrected, enter table 26 with the nearest degree of the latitude by account and the declination, having regard if they are of same or different name, and take out the corresponding number and multiply it by the hour angle square. The result will be the correction in seconds (") to be always added to the true altitude. The zenith distance is then found and the latitude determined in the usual way.

Table 26 may be used for any body not exceeding twenty-four degrees declination, but the same table in the new edition can be used for declinations to 63°

Example: December 20, 1902. The observed altitude of the sun's lower limb was 47° 10′ 00″ S. Longitude by account 65° 00′ 00″ W. Time by chronometer 4h 17m 19s P. M., and fast 3m 07s. Height of eye 19 feet. Latitude by account 19° 12′ N.

Chro. time	4h	17m	19s	P. M.
Fast	—	3	07	
G. M. T.	4	14	12	P. M.
Equ. of time	+	2	33	
G. A. T.	4	16	45	
Long. 65° W. =	— 4	20	00	
L. A. T.	11	56	45	A. M.
	12	00	00	
Hour angle 3m.25 =		3	15	

Equ. of time	2m	38s.26	
Cor.	—	5.26	
Cor. equ. of time	2	33.00	

Dec.	23°	25′	45″.2 S
Cor.	+		11.3
Cor. dec.	23	25	56.5 S.

H. D.	1s.239
G. M. T.	× 4h.25
	6195
	2478
	4956
Cor. 5s.26 =	5s.26575

H. D.	2".67
G. M. T.	× 4h.25
	1335
	534
	1068
Cor. 11".3 =	11".3475

Obs. alt. L. L.	47°	10′	00″	S.
Semi-diam.	+	16	17	
	47	26	17	
Dip	—	4	16	
	47	22	01	
Ref.	—		54	
	47	21	07	
Par.	+		06	
True alt.	47	21	13	
Cor.	+		27	
Mer. alt.	47	21	40	
	90	00	00	
Zen. dist.	42	38	20	N.
Cor. Dec.	— 23	25	56	S.
Lat.	19	12	24	N.

H. A.^{2} = 3m.25 × 3m.25

3m 25
× 3m.25
1625
650
975
H. A.^{2} = 10.5625
Table 26 × 2".6
633750
211250
Cor. 27" = 27.46250

See problems on pages 26 and 27, Pugsley's Guide to Local Inspectors Examinations.

Example: March 27, 1902. The observed altitude of the sun's lower limb was 50° 10′ 10″ S. Longitude by account 63° 30′ 00″ W. Time by chronometer 4h 56m 38s P. M., and slow 4m 28s. Height of eye 30 feet. Latitude by account 40° 56′ 00″ N.

Chro. time	4h	56m	38s	P. M.
Slow	+	4	28	
G. M. T.	5	01	06	P. M.
Equ. of time	—	5	38	
G. A. T.	4	55	28	
Long. 63° 30′ W. =	— 4	14	00	
L. A. T.	12	41	28	
	—12	00	00	
Hour angle 41m.5 =		41	28	

Equ. of time	5m	41s.99	
Cor.	—	3.84	
Cor. equ. of time	5	38.15	

Dec.	2°	20′	26″.0 N.
Cor.	+	4	53.8
Cor. dec.	2	25	19.8 N.

H. D.	0s.769
G. M. T.	× 5h
Cor. 3s.84	3s.845

H. D.	58".77
G. M. T.	× 5h
Cor. 4′ 53″.8 =	293".85

Obs. alt. L. L.	50°	10′	10″	S.
Semi-diam.	+	16	03	
	50	26	13	
Dip	—	5	22	
	50	20	51	
Ref.	—		49	
	50	20	02	
Par.	+		06	
True alt.	50	20	08	
Cor.	+	1	08	03
Mer. alt.	51	29	01	
	90	00	00	
Zen. dist.	38	30	59	N.
Cor. dec.	+ 2	25	20	N.
Lat.	40	56	19	N.

H. A.^{2} = 41m.5 × 41m.5

41.5
× 41.5
2075
415
1660
H. A.^{2} = 1722.25
Table 26 2".4
688900
344450
Cor. 1° 08′ 53" = 4133.400

Finding the Set and Drift of a Current.

It is the custom to keep track of a ship by dead reckoning so that at noon two positions will be entered in the log. One by account and the other by observation, weather permitting.

Where a ship is engaged in the same trade constantly an acquaintance with the currents and the local conditions which influence them becomes a necessity and particularly so as they are subject to a number of changes known only to those having a local knowledge obtained by experience. As a matter of fact the subject should have more attention than it generally receives because the chief source of information on which sailing directions are based is the navigator of the seagoing ship who has the information of those who have gone before him. Therefore it seems to be his duty to obtain what information he can that it may be imparted to others, and by doing so he is contributing something for the general benefit of commerce and all mankind.

The ship's position at noon having been fixed by proper observations, is compared with that by account. If they are the same it is evident that the ship has not been influenced by a current during the past 24 hours. If they are different it is safe to assume that a current did exist. The set and drift will be the course and distance from that by account to the position by observation. As the position of the ship is fixed quite frequently when it is possible to do so, the action of an existing current may be determined at intervals of much less than 24 hours; but in the following problems it is assumed that the ship has gone one whole day before having the position by observation fixed.

Example: At noon the position by account was latitude 36° 15′ N. and longitude 74° 30′ W., and by observation latitude 36° 29′ N. and longitude 74° 15′ W.

Lat. D. R.	36° 15′ N.		Long. D. R.	74° 30′ W.	
" Obs.	36 29 N.		" Obs.	74 15 W.	
Dif.	14 N.		Dif.	15 E.	

36° 15
36 29
2) 72 44
Mid. lat. 36 22 = 36° dif. long. 15′ = dep. 12′.1
Dif. lat. 14′ N.
Dep. 12 .1 E. = set N. 41° E. drift 18′.5 daily.

24) 18′.5 (.77 = hourly drift 0′.77
168
170
168
2

Example: At noon the position by account was latitude 20° 40′ N. and longitude 84° 02′ W., and by observation latitude 21° 10′ N. and longitude 84° 34′ W.

Lat. D. R.	20° 40′ N.		Long. D. R.	84° 02′ W.	
" Obs.	21 10 N.		" Obs.	84 34 W.	
Dif.	30 N.		Dif.	32 W.	

20° 40
21 10
2) 41 50
Mid. lat. 20 55 = 21° dif. long. 32′ = dep. 29′.9
Dif. lat. 30′ N.
Dep. 29 .9 W. = set N. 45° W. drift 42′.4 daily.

24) 42′.4 (1.77 = hourly drift 1′.77
24
184
168
160
168
8

"NEW JERSEY" ANTI-CORROSIVE PAINT.

WONDERFUL TEST

FOR "NEW JERSEY"

Anti-Fouling Composition

THIS cut is a copy of a photograph of a piece of iron, one end of which was painted with **"NEW JERSEY" ANTI-FOULING COMPOSITION,** manufactured by HARRY LOUDERBOUGH, Proprietor of NEW JERSEY PAINT WORKS, Jersey City, N. J., U. S. A. It was placed for six months in the harbor of Norfolk, Va. Upon the unpainted end note the large number of barnacles and also the vegetable growth fastened to it.

Observe where "New Jersey" Anti-Fouling Composition was applied. Its splendid condition

Reg. U. S. Pat. Office, No. 54,433.

"NEW JERSEY" ANTI-FOULING COMPOSITION.

Our Marine Paint SPECIALTIES

"NEW JERSEY"

- BROWN COPPER PAINT
- BRIGHT GREEN COATING
- YACHT RED COPPER PAINT
  Very Bright.
- YACHT GREEN COP'R PAINT
- ELASTIC SEAM PAINT
- YACHT BLACK
- YACHT WHITE
- MAST PAINT
- SMOKE-STACK PAINT
- SHIP AND DECK PAINT

Our Productions are absolutely **THE BEST.** *We make NO cheap or inferior goods.*

Compass Error and Deviation by Azimuth.

Observe the bearing by compass and the altitude, and correct the altitude and find the polar distance same as in finding longitude by chronometer. Instead of noting the time by chronometer, the Greenwich time can be found by adding the longitude in time, if west, to the ship's time. If longitude is east, subtract longitude in time from the ship's time.

Add together the polar distance, latitude and altitude, and divide the sum by 2 and find the difference between the half sum and polar distance.

From table 44 take the log. secant of the latitude; log. secant of the altitude; log. cosine of the half sum and log. cosine of the difference. Half their sum will be the cosine of half the true azimuth, which when multiplied by 2 will give the true azimuth, and name it same as the latitude and reckon it towards the east if ship's time is A. M., and towards the west if ship's time is P. M.

The difference between the compass and true azimuths will be the compass error, and if the true azimuth falls to the left of the compass azimuth, the error is west; if to the right, it is east.

To the compass error, apply the variation from the chart, to find the deviation.

Example: Sept. 18, 1902, A. M. The observed altitude of the sun's lower limb was 18° 24′ 30″. G. M. T. 1h 11m 17s P. M. Latitude by account 19° 56′ N. The sun's bearing by compass was N. 78° E. Variation by chart 6° E. Height of eye 35 feet.

Obs. alt. L. L.	18° 24′ 30″	Dec.	2° 08′ 11″ N.	H. D.	58″.1
Semi-diam.	+ 15 56	Cor.	1 10	G. M. T.	× 1.2
	18 40 26	Cor. dec.	2 07 61		1162
Dip	— 5 48		90 00 00		581
	18 34 38	P. D.	87 52 59		1′ 10″ = 69.72
Ref.	— 2 52				
	18 31 46				
Par.	+ 08				
True alt.	18 31 54				

P. D.	87° 52′ 59″			½ true az.	47° 18′
Lat.	19 56 00	Sec.	.02683		× 2
Alt.	18 31 54	Sec.	.02313	True az.	N. 94 36 E.
	2)126 20 53			Com. az.	N. 78 00 E.
½ sum	63 10 26	Cos.	9.65456	Com. error	16 36 E.
P. D.	87 52 59			Var. (chart)	6 00 E.
Diff.	24 42 33	Cos.	9.95827	Dev.	10 36 E.
			2)19.66279		
½ true az.	47° 18′	= Cos.	9.83139		

Example: Aug. 9, 1902. The observed altitude of the sun's lower limb was 43° 55′ 00″. Longitude by account 83° 25′ W. Latitude by account 23° 51′ N. Local apparent time 8h 47m A. M. The sun's bearing by compass was N. 95° E. Variation by chart 5° E. Height of eye 25 feet.

Obs. alt. L. L.	43° 55′ 00″	L. A. T.		8h 47m 00s	A. M.	
Semi-diam.	+ 15 48	Long. 83° 25′ W.	= +	5 33 40		
	44 10 48	G. A. T.		2 20 40	P. M.	
Dip	— 4 54					
	44 05 54	Dec.		16° 03′ 47″ N.	H. D.	42″.81
Ref.	— 1 00	Cor.		— 1 38	G. A. T.	× 2h 3
	44 04 54	Cor. dec.		16 02 09		12843
Par	+ 07			90 00 00		8562
True alt.	44 05 01	P. D.		73 57 51		1′ 38″=98.463

P. D.	73° 57′ 51″			½ true az.	45° 13′
Lat.	23 51 00	Sec.	.03877		× 2
Alt.	44 05 01	Sec.	.14368	True az.	N. 90 26 E.
	2)141 53 52			Com. az.	N. 95 00 E.
½ sum	70 56 56	Cos.	9.51374	Com. error.	4 34 W.
P. D.	73 57 51			Var. (chart)	5 00 E.
Diff.	3 00 55	Cos.	9.99940	Dev.	9 34 W.
			2)19.69559		
½ true az.	45° 13′	= Cos.	9.84779		

Example: Feb. 27, 1902. The observed altitude of the sun's lower limb was 51° 15′ 10″. Longitude by account 101° 58′ W. Latitude by account 33° 52′ S. Local apparent time 2h 15m P. M. The sun's bearing by compass was S. 129° W. Variation by chart 7° W. Height of eye 49 feet.

Obs. alt. L. L.	51° 15′ 10″	L. A. T.	2h 15m 00s P. M.		
Semi-diam.	+ 16 10	Long. 101° 58′ W.	−+6 47 52		
	51 31 20	G. A. T.	9 02 52 P. M.		
Dip	− 6 56				
	51 24 24	Dec.	8° 34′ 43″ S.	H. D.	56″.19
Ref.	− 47	Cor.	− 8 26	G. A. T.	× 9
	51 23 37	Cor. dec.	8 26 17	8′ 26″	505.71
Par.	+ 06		90 00 00		
True alt.	51 23 43	P. D.	81 33 43		

P. D.	81° 33′ 43″			½ true az.	61° 57′
Lat.	33 52 00	Sec.	.08075		× 2
Alt.	51 23 43	Sec.	.20490	True az.	S. 123 54 W.
	2)166 49 26			Com. az.	S. 129 00 W.
½ sum	83 24 43	Cos.	9.05937	Com. error.	5 06 W.
P. D.	81 33 43			Var. (chart)	7 00 W.
Diff.	1 51 00	Cos.	9.99977	Dev.	1° 54′ E.
			2)19.34479		
½ true az.	61° 57′	− Cos.	9.67239		

Use of the Azimuth Tables.

Instead of computing the true bearing or azimuth of a heavenly body, it may be taken from the azimuth tables by inspection, and when the conditions are such that the true bearing is frequently necessary, considerable labor and time is saved by their use.

They are convenient for finding the most favorable time to obtain an observation for longitude—that is, when the body bears nearest true east or west, also for plotting Summer lines. The initial and final courses of a great circle track may be obtained by these tables.

When using the tables for the moon, stars or planets, in place of the local apparent time, find the hour angle of the body and with it enter the P. M. column. When making an amplitude, convert the compass bearing into an azimuth.

To find the sun's true bearing, enter the table with the local apparent time and declination under the proper latitude, having regard if the latitude and declination are of same or different name, and the true azimuth will be found at the intersection of the time and declination.

To find the most favorable time for an observation of the sun for longitude, enter the table under the proper latitude and declination and abreast of the bearing nearest 90° will be found the time—A. M. or P. M., as the case may be. For the moon, star or planet, the hour angle will be found in the P. M. column.

For plotting Summer lines, it is only necessary to draw a line through one longitude at right angles to the true bearing of the body observed.

The azimuth tables are used in finding the initial and final courses of a great circle track by taking the latitude left as the latitude, the latitude of the point bound to as the declination and the difference of longitude as the hour angle. The corresponding angle will be the initial course. The operation may be repeated from different points of the track until the other courses are found. The final is found by using the latitude bound to as the latitude left, and the latitude left as that of the destination.

Jersey City, September 24, 1890.

Mr. H. Louderbough.

Dear Sir.—I painted schooner "Enchantress" last January on Perth Amboy Dry Dock with one coat of New Jersey Copper Paint, and after running all summer to Port Royal and Charleston, S. C., I lifted to-day at Bulman & Brown's Dry Dock, and found my vessel in splendid condition, her seams being full of barnacles, but her painted bottom was as smooth as when painted.

FRANK ROLLENT.

Edgartown, Mass., January 19, 1891.

H. Louderbough.

Dear Sir.—I used the New Jersey Copper Paint sent me, and it proved to be as represented, "the best in the market." I have used several different kinds, but never found any that would run over three months; but this ran six months, and was as clean from grass and barnacles as when it was applied.

I remain, yours, &c.,

JAMES C. SANDSBURY.

Explanation of Compass Terms.

Variation of the compass is the difference between the magnetic compass on the chart and the true compass in any particular locality.

Deviation of the compass is the difference between the magnetic compass on the chart and the ship's compass, and is caused by the iron and steel of which the ship may be wholly or partly constructed, and like substance in the cargo.

Local attraction is the effect of iron or steel or like substance outside the ship, such as pier sheds, mooring bits, dock machinery, etc.

Heeling error is the quantity a ship affects the compass by heeling. It may either increase or decrease the deviation.

Leeway is the angle between the compass course and the direction the ship makes through the water.

Compass error is the joint effect of variation and deviation.

Compass course is the course steered by the ship's compass.

Magnetic course is that taken from the magnetic compass on the chart.

True course is the course steered by compass corrected for every influence affecting it.

In the tropics, the sun's heat on the side of a black painted iron ship has been known to affect the compass to the extent of eight or nine degrees.

Deviation of the Compass by an Amplitude.

When the sun's center is on the horizon, observe its bearing and note the course and time by the ship's clock. Correct the clock time for the ship's run since last regulated, and apply the longitude to find the Greenwich time, and with it, correct the declination.

Add together the secant of the latitude and sine of the declination, and the sum will be the sine of the true amplitude reckoned from the east or west and takes the name of the declination. The difference between the two bearings will be the compass error. When the compass amplitude is to the left of the true amplitude, the error is east; to the right, it is west. To the compass error, apply the variation from the chart to find the deviation.

Example: March 7, 1902. Latitude by account 30° 12′ N. Longitude by account 68° 00′ W. The observed amplitude of the sun's center was E. 6° 00′ N. Local apparent time 6h 12m A. M. Variation 6° 00′ W.

L. A. T.		6h 12m A. M.		Dec.	5° 31′ 23″ S.		H. D.	58″.20
Long. 68°00′=	+	4 32		Cor.	+ 1 16		Time from noon	×1h.3
G. A. T.		10 44	A. M.	Cor. dec.	5 32 39 S.			17460
		12 00						5820
Time from noon		1 16					Cor. 1′ 16″=75″.660	

Lat.		30° 12′ N.	Sec.	.06335	
Dec.		5 32 S.	Sin.	8.98419	
True amp.	E. 6° 24′ S.		=Sin.	9.04754	
Com. "	E. 6 00 N.				
Com. error	12 24 E.				
Var. (chart).	6 00 W.				
Dev	18 24 E.				

Example: July 14, 1902. Latitude by account 33° 15′ N. Longitude by account 67° 30′ W. The observed amplitude of the sun's center was W. 36° 00′ N. Local mean time 7h 07m P. M. Variation 7° 00′ W.

L. M. T.		7h 07m P. M.		Dec.	21° 47′ 43″ N.		H. D.	22″.05
Long. 67° 30′ W.=	+	4 30		Cor.	− ° 4 16		G. M. T.	11h.6
G. M. T.		11 37	P. M.	Cor. d c.	21 43 27 N.			19230
								2205
								2205
							Cor. 4′ 16″=255″.780	

Lat.		33° 15′ N.	Sec.	.07765	
Dec.		21 43 N.	Sin.	9.56822	
True amp.	W. 26 16 N.		=Sin.	9.64587	
Com. "	W. 36 00 N.				
Com. error	9 44 W.				
Var. (chart)	7 00 W.				
Dev.	2 44 W.				

NON-EXPLOSIVE

NON-BURNABLE

Deviation of the Compass by Equi-distant Bearings.

When it is necessary to swing a ship to determine the deviation from bearings of a distant land object the magnetic bearing of which is not known, an accurate table of deviation may be constructed by this method. It is more reliable than if determined by observations of some heavenly body, because, while the compass error found in that manner will be correct, the accuracy of the deviation will depend on that of the variation as shown by chart which is sometimes in error.

The chief conditions on which the accuracy of this method depends are that the object must be distant not less than 6 miles and the bearings observed at not less than 8 equi-distant points of the compass. For practical purposes it is better to use every point making a total of 32 bearings. After having obtained the bearings the ship may be swung around the opposite way to determine if the bearings are correct. If they are different the condition of the agate or pivot of the compass is bad, unless an error was made by the observer. If the compass is not in good condition, it and the deviations will not be reliable.

The mean of the compass bearings will be the magnetic bearing and the difference between that and the compass bearing will be the deviation for the point on which the ship was heading.

If all the bearings are east or west read them from north to south, and their mean is found by dividing the sum by the number of bearings observed. If they fall on both sides of the compass add the east and west separately taking care to read all of them from either north or south and divide the difference, giving it the name of the greater, by the number of compass bearings observed and the resulit will be the magnetic bearing.

"New Jersey" Copper Paint Labels in Seven Foreign Languages.

BACK LABEL IN ITALIAN.

"NEW JERSEY"

Un Fatto Remarcabile.

QUESTE intaglio he una copia di una fotografia di una tavola havendo una punta pittato colla **"NEW JERSEY" COPPER PITTURA,** manufatturata di Harry Louderbough, praprietario dei LAVORI DI PITTURA DI "NEW JERSEY," Jersey City, N. J., e posta nell' acqua a Porto Royal, S. C., per cinque mesi. Sopra la punta non pittata potete vedere le rovini del verme di acqua salata cosi destruttive al legno, e pure il gran numero di crocchioli che sono attaccate sopra. Osserva la punta pittata, dove la **"New Jersey" Copper Pittura** fu usata, le suoi splendide condizione.

La tavola qui representata fu posta nell' acqua a Porto Royal, S. C., di me e lasciata nell' acqua per cinque mesi. La punta pittata era buona come quando fu posta nell' acqua.

MILLS EDWARD,
Maestro di Scuna "Florence Shay."

MARCA DE FABRICA.
REGISTRADA IN EUROPA.

"NEW JERSEY"
Copper Pittura.

COPPER PITTURA

Nostra Marina Pittura

ESPECIALITA.

"New Jersey"
- Copper Pittura, Anti-Corrosiva, Anti-Taulingh,
- Rosso Copper Pittura Per Ferro
- Verde Copper Pittura Per Vascelle
- Elastica Siim Pittura,
- Vascella Nera,
- Vascella Bianca,
- Pittura d'Aberi Vascelle
- Pittura di Fumajuolo,
- Puppa e Suolo Pittura.

La Fera del Americano Instituto di New York ne ha premiato colla piu alta ottenevole Meueglia per la nostra "New Jersey" Copper Pittura, Siim Pittura e Pile Preservativa Pittura.

NEW JERSEY PAINT WORKS,
HARRY LOUDERBOUGH, Inc.
JERSEY CITY, N. J., U. S. A.

Example: A ship was swung and the bearings of Progresso light were observed as follows:

Ship's Head by Compass	Bearing of Object by Compass	Deviation	Ship's Head by Compass	Bearing of Object by Compass	Deviation
N.	S. 2 ° E.	2 ° E.	S.	S. 1½° W.	1½° W.
N. E.	S. 3½ E.	3½ E.	S. W.	S. 3 W.	3 W.
E.	S. 4 E.	4 E.	W.	S. 4 W.	4 W.
S. E.	S. 2½ E.	2½ E.	N. W.	S. 3½ W.	3½ W.

E.	W.	Mag. bear.	S. 0°	S. 0°	S. 0°	S. 0°
2	1½	Com. "	S. 2 E.	S. 3 30′ E.	S. 4 E.	S. 2 30′ E.
3½	3	Dev.	2 E.	3 30	4 E.	2 30 E.
4	4					
2½	3½	Mag. bear.	S. 0°	S. 0°	S. 0°	S. 0°
12	12	Com. "	S. 1 30′ W.	S. 3 W.	S. 4 W.	S. 3 30′ W.
	12		1 30 W.	3 W.	4 W.	3 30 W.

0 = magnetic bearing S.

Example: A ship was swung and the bearings of Cape Maysi light were observed as follows:

Ship's Head by Compass	Bearing of Object by Compass	Deviation	Ship's Head by Compass	Bearing of Object by Compass	Deviation
N.	S. 6° E.	5° E.	S.	S. 4° W.	5° W.
N. E.	S. 4 E.	3 E.	S. W.	S. 3 W.	4 W.
E.	S. 2 E.	1 E.	W.	S. 1 E.	0
S. E.	S. 2 W.	3 W.	N. W.	S. 4 E.	3 E.

E.	W.	Mag. bear.	S. 1° E.	S. 1° E.	S. 1° E.	S. 1° E.
6	2	Com. "	S. 6 E.	S. 4 E.	S. 2 E.	S. 2 W.
4	4	Dev.	5 E.	3 E.	1 E.	3 W.
2	3					
1		Mag. bear.	S. 1° E.	S. 1° E.	S. 1° E.	S. 1° E.
4		Com. "	S. 4 W.	S. 3 W.	S. 1 E.	S. 4 E.
17	9	Dev.	5 W.	4 W.	0	3 E.
9						

8) 8 (1 = magnetic bearing S. 1° E.
8

Example: A ship was swung and the bearings of Barnegat light were observed by compass as follows:

Ship's Head by Compass	Bearing of Object by Compass	Deviation	Ship's Head by Compass	Bearing of Object by Compass	Deviation
N.	N. 83 W.	17° W.	S.	S. 66° W.	14° E.
N. E.	S. 85 W.	5 W.	S. W.	S. 70 W.	10 E.
E.	S. 70 W.	10 E.	W.	S. 88 W.	8 W.
S. E.	S. 68 W.	12 E.	N. W.	N. 84 W.	16 W.

97	Mag. bear.	S. 80° W.	S. 80° W.	S. 80° W.	S. 80° W.
85	Com. "	S. 97 W.	S. 85 W.	S. 70 W.	S. 68 W.
70		17 W.	5 W.	10 E.	12 E.
68					
66	Mag. bear.	S. 80° W.	S. 80° W.	S. 80° W.	S. 80° W.
70	Com. "	S. 66 W.	S. 70 W.	S. 88 W.	S. 96 W.
88		14 E.	10 E.	8 W.	16 W.
96					

8) 640 (80 = magnetic bearing, S. 80° W.
640

Latitude by Meridian Altitude of Fixed Star.

Observe the meridian altitude of the star and correct it for instrumental error, dip and refraction, and subtract it from 90° and the result will be the zenith distance, which is named contrary to the star's bearing. If the zenith distance and declination are of same name, add them together; but if of different name, take their difference, and the result will be the latitude which takes the name of the greater.

Before observing the meridian altitude of a star, it is customary to compute the time it will pass the meridian and the altitude at that instant.

To find the time a star will pass the meridian, subtract the sun's right ascension from the star's right ascension, and the result will be the local apparent time of the star's meridian passage. If the local mean time of the star's meridian passage is required, use the sidereal time instead of the sun's right ascension. If the star's right ascension is less than that of the sun, it must be increased by twenty-four hours.

To compute the altitude, subtract the latitude by account from 90°, and the remainder will be the co-latitude. If the latitude and star's declination are of same name, add them together, but if of different name, take their difference and the result will be the star's true meridian altitude. To this add the dip and refraction to obtain the altitude that will be observed if the latitude by account is correct. If the instrument is set to correspond with the computed altitude, the observer will find the proper star without difficulty.

Example: January 16, 1902. Latitude by account 37° 19′ N. The latitude by meridian altitude of the star Castor is required. Height of eye 36 feet.

Star's R. A.		7h	28m	21s
Add		24	00	00
		31	28	21
Sun's R. A		19	49	43
L. A. T. Star's Mer. Pass.		11	38	38 P.M.

Obs. alt.		84°	53′	07″ S.
Dip	—		5	48
		84	47	19
Ref.	—			05
		84	47	14
True alt		90	00	00
Zen. dist.		5	12	46 N.
Star's dec.	+	32	06	14 N.
Lat.		37	19	00 N.

Lat. by account		37°	19′	00″ N.
		90	00	00
Co-lat.		52	41	00
Star's dec.	+	32	06	14 N.
True alt		84	47	14 S.
Dip	+		5	48
		84	53	02
Ref	+			05
Obs. alt.		84	53	07 S.

By this observation the latitude by account is found to be correct.

Example: March 17, 1902. Observed altitude of the star Rigel was 53° 40′ 30″ S. I.C.+2′ 10″. Height of eye 40 feet.

Obs. alt.		53°	40′	30″ S.
I. C.	+		2	10
		53	42	40
Dip	—		6	12
		53	36	28
Ref.	—			42
		53	35	46
		90	00	00
Zen. dist.		36	24	14 N.
Star's dec.	—	8	18	53 S.
Lat.		28	05	21 N.

"New Jersey" Marine Mixed Paints

being quick drying they are very desirable for vessels, also by their combination they hold the oil much longer than other paints and you do not have the annoyance of having a slow drying paint on your vessel.

Example: Sept. 24, 1902. Latitude by account 16° 15′ S. The latitude by the star Aldebaran is required. Height of eye 30 feet.

Star's R. A.	4h	30m	18s	
Add	24	00	00	
	28	30	18	
Sid. time.	12	05	36	
Ast. time, Sept. 23	16	24	42	
	−12	00	00	
L. M. T. Star's Mer. Pass.	4	24	42	A.M.

Obs. alt	57°	36′	30″	N.
Dip.	−	5	22	
	57	31	08	
Ref.	−		36	
True alt.	57	30	32	
	90	00	00	
Zen. dist.	32	29	28	S.
Star's dec.	−16	18	45	N.
Lat.	16	10	43	S.

Lat. by account.	16°	15′	00″	S.
	90	00	00	
Co-lat.	73	45	00	
Star's dec.	−16	18	45	N.
True alt.	57	26	15	N.
Dip	+	5	22	
	57	31	37	
Ref.	+		36	
Obs. alt.	57	32	13	

By this observation the latitude by account is found to be about 4′.1 in error.

Astronomical Time.

That everyone attempting to learn nautical astronomy experiences more or less difficulty in understanding astronomical time is a fact conceded by navigators generally.

An effort is made here to explain it as simply as possible that it may be thoroughly comprehended by all interested.

The civil day is reckoned from one midnight to the next. The first half is called A. M., and the second half P. M. It is the date used in ordinary business transactions.

The astronomical day is reckoned from one noon to the next, and the hours are counted consecutively from 0h to 24h. It is the time used generally in astronomical calculations. When the civil date is A. M., the astronomical date is one day behind it, and when the civil date is P. M., the dates correspond.

By a little study it may be noticed that astronomical time is the hours past the last noon, and the civil date of that noon will be the astronomical date.

Suppose it is desired to turn the civil date, June 4th, 6h 10m A. M. into astronomical time. It is clear that 6h 10m A. M. is 18h 10m past the last noon. It is also clear that the last noon occurred on June 3d. Therefore the astronomical date and time is June 3d, 18h 10m. Suppose the civil time is August 8th, 7h 12m P. M. The time is 7h 12m past the last noon, and the last noon occurred on August 8th. It follows then, that the astronomical date and time is August 8th, 7h 12m, which corresponds with the civil time and date.

TESTIMONIALS.

"NEW JERSEY" ANTI-CORROSIVE PAINT—No. 1 ANTI-FOULING PAINT—No. 2.

Jersey City, N. J.,

Harry Louderbough.

Dear Sir.—Your "New Jersey" Copper Paint and your Anti-Corrosive and Anti-Fouling Paints have for many years been used very freely at our Dry Docks, and we can cheerfully give them the hearty endorsement they deserve, for they have both satisfied our patrons as well as ourselves.

Yours truly,

THE BROWN DRY DOCK COMPANY.

Jersey City, N. J.,

Mr. H. Louderbough.

Dear Sir.—Our acquaintance with marine paints has run over a number of years, and it is with great pleasure we endorse your "New Jersey" Copper Paint, Anti-Corrosive and Anti-Fouling Paints. Also, your production of Iron Crown Paint for Iron Vessels and your Wetterstedt Copper Paint.

Yours truly, BURT & MITCHELL CO.

Brooklyn, N. Y.,

Mr. Harry Louderbough.

Dear Sir.—I have used at our Dry Docks your Bottom Paint for Iron Vessels, and found your "New Jersey" Anti-Corrosive and Anti-Fouling Paints very effective Paints. Both can be applied quickly, saving all annoyance of delays. Their use has been gratifying to my customers and myself.

Very truly yours.

WM. GOKEY.

Hampton, Va.,

Mr. H. Louderbough.

Dear Sir.—After having used your New Jersey Copper Paint at our Railways in Hampton, we take great pleasure in recommending the same to all users of Copper Paint. The good qualities of New Jersey Copper Paint make it very popular with us and our trade.

Yours truly,

WARREN HALL & CO.,

Props. Marine Railway at Hampton, Va.

Time.

The time in general use, and shown by clocks, chronometers, etc., is mean time, and therefore does not correspond with the motion of the sun.

Because of the form of the earth's orbit, the apparent solar day, which is the interval between two successive passages of the sun over the same meridian, is not of uniform length, and varies daily. It then follows that no piece of mechanism could be constructed to keep such time. However, the difficulty has been overcome by taking the average length of the apparent solar day, and giving it a mean value of twenty-four uniform hours. At certain seasons of the year, this time corresponds exactly with the apparent time, while at others, the mean solar day is as much as sixteen minutes shorter, and finally becomes about fourteen minutes longer. This difference is called the equation of time and is found in the nautical almanac for every day in the year, and also, how to apply it.

Navigators always obtain apparent time from their observations, and readily turn it into mean time by applying the equation of time. By the opposite operation, they turn mean time into apparent time.

For the sake of convenience a system of keeping mean time has been adopted. The meridians taken for this purpose are 15° or one hour apart. All clocks on such meridians and within 7° 30′ of them, are regulated to the same local mean time. By this system of time, a person receiving a letter or telegram may determine the length of time it required to reach him.

Suppose a person in Jersey City receives a telegram at 9h P. M., from San Francisco, and showed that it had been started at 1h P. M. The clocks in San Francisco are regulated to Pacific time, which is 3h slower than Eastern time to which the clocks in Jersey City are regulated. Then the telegram must have been started at 4 P. M. (Eastern time), which shows that it required five hours to reach Jersey City.

The following shows the various times, and their meridians, using New York as a reference:

GREENWICH.

Longitude 0°, and five hours faster than New York time, and is that time to which navigators' chronometers are regulated.

INTERCOLONIAL.

Longitude 60° W., and one hour faster than New York time.

EASTERN.

Longitude 75° W., and that time to which clocks in New York are regulated.

CENTRAL.

Longitude 90° W., and one hour slower than New York time.

MOUNTAIN.

Longitude 105° W., and two hours slower than New York time.

PACIFIC.

Longitude 120° W., and three hours slower than New York time.

SITKA.

Longitude 135° W., and four hours slower than New York time.

TAHITI.

Longitude 150° W., and five hours slower than New York time.

PACIFIC CENTRAL.

Longitude 165° W., and six hours slower than New York time.

ANTIPODES.

Longitude 180° and seven hours slower than New York time.

"New Jersey"

ANTI-CORROSIVE PAINT No. 1.
PRIMING COAT.

ANTI-FOULING PAINT No. 2.
FINISHING COAT.

BEST QUALITY. HIGHEST TESTIMONIALS.

Latitude by Meridian Altitude of the Moon.

From the nautical almanac (page 4 of the month) take the time of the moon's meridian passage at Greenwich for the civil date if the time is P. M. If the time is A. M., take it out for the preceding date. Multiply the hourly difference by the longitude in time, and in west longitude add the product, and in east longitude subtract it from the time of the meridian passage at Greenwich, and the result will be the local mean time of the meridian passage in the longitude used. The Greenwich mean time of the passage in that longitude is found by adding the longitude in time, if west, and subtracting it if east, from the local mean time of the moon's meridian passage.

The altitude is to be observed in the usual manner, and corrected for semi-diameter and dip. The semi-diameter is found on page 4 (of the month) and must be taken out for either noon or midnight, according to which the Greenwich time is nearest. The horizontal parallax is taken from the same page in the same manner.

Take out the declination for the Greenwich day and hour, and correct it for the odd minutes.

The altitude having been corrected for semi-diameter and dip, enter table 24 with it, and the horizontal parallax, and take out the corresponding correction, which is the parallax in altitude, and is always additive to the altitude, and the result will be the true altitude.

Having found the true meridian altitude and corrected the declination to the Greenwich instant of observation, proceed the same as finding latitude by meridian altitude of the sun.

Note.—The semi-diameter, horizontal parallax and declination must be for the same date as the meridian passage.

There are small corrections for the semi-diameter and parallax; but as their value is very small and of little or no importance to this observation, they are not treated here.

Example: August 15, 1902, P. M. The observed meridian altitude of the moon's lower limb was 43° 54′ S. Longitude by account 75° W. Height of eye 26 feet.

Mer. Pass at G.	9h. 23m.7	H. D. 1m. 99
Cor.	+ 9 .9	Long 75°= × 5h
L. M. T. Mer. Pass.	9 33 .6	Cor. 9m. 9=9.95
Long 75°W.=	+ 5 00 .0	
G. M. T. Mer. Pass.	14 33 .6	

Obs. alt. L. L.	43° 54′ 00″ S.
Dip	— 5 00
	43 49 00
Semi-diam.(mdt)	+ 14 54
	44 03 54
Par.	+ 38 35
True alt.	44 42 29
	90 00 00
Zen. dist.	45 17 31 N.
Cor. dec.	−17 32 55 S.
Lat.	27 44 36 N.

Dec. 14h.	17° 35′ 09″ S.
Cor.33m.6=	2 14
Cor. dec.	17 32 55

M. D.	3″.996
	× 33m.6
	23976
	11988
	11988
Cor.2′14″=	134.2656

Hor. par. (mdt.) 55′=Par alt. 38′35′

Example: November 21, 1902, A. M. The observed altitude of the moon's lower limb was 43° 15′ 30″ N. Longitude by account 75° E. Height of eye 40 feet.

Mer. Pass. at G.	17h. 01m.5	H. D. 2m. 23
Cor.	— 11 .1	Long. 75° = × 5h
L. M. T. Mer. Pass.	16 50 .4	Cor. 11m.1= 11.15
Long. 75° E.	— 5 00 .0	
G. M. T. Mer. Pass.	11 50 .4	

Obs. alt. L. L.	43° 15′ 30″ N.
Dip	— 6 12
	43 09 18
Semi-diam. (mdt).	+ 16 09
	43 25 27
Par.	+ 41 48
True alt.	44 07 15
	90 00 00
Zen. dist.	45 52 45 S.
Cor. dec.	−12 45 45 N.
Lat.	33 07 00 S.

Dec. 12h.	12° 44′ 23″ N.
Cor.9m.6+	1 22
Cor dec.	12 45 45 N.

M. D.	8″.532
	× 9m.6
	51192
	76788
Cor. 1′ 22″ =	81.9072

Hor. par.(mdt.) 59′=Par.alt. 41′ 48′

To Find Longitude by a Star.

Observe an altitude when the star is on or as near the prime vertical as possible and note the time by chronometer. Correct the altitude for index error, dip and refraction, and apply the rate of the chronometer to the time noted. Take the star's declination from the nautical almanac, and correct it if necessary, and subtract it from 90° if same name as latitude. If of different name, add it to 90°, and the result will be the polar distance. On the same page where the declination was found, will be the star's right ascension. Correct sidereal time for the Greenwich time by table 9, and the result will be the corrected sidereal time or right ascension of the mean sun. From half the sum of the true altitude, latitude and polar distance, subtract the true altitude, and the result will be the remainder. Then add together the log. secant of the latitude, log. cosecant of the polar distance, log. cosine of the half sum and log. sine of the remainder, and divide their sum by two, and the result will be the log. sine of the star's hour angle, which is always taken from the P. M. column. If the star is west of the meridian, add its right ascension to the hour angle; but if the star is east of the meridian, subtract the star's hour angle from the star's right ascension, and if the right ascension is too small, add twenty-four hours to it, and the result will be the right ascension of meridian. From the right ascension of meridian, subtract the corrected sidereal time or right ascension of mean sun; but if the right ascension of meridian is too small, add twenty-four hours to it, and the result will be the local mean time at ship. The difference between the local mean time and Greenwich mean time will be the longitude in time, and this is turned into degrees, etc.

Example: January 1, 1902, P. M. Latitude by account 51° 30′ N. Observed altitude of the star *a* Arietis east of the meridian was 52° 20′. Time by chronometer 9h 17m 06s P. M., and slow 9m 7s. Height of eye 35 feet. I. C. 10′ +.

Obs. alt.		52°	20′	00″	Chro.		9h	17m	06s	Dec.	22° 59′ 57″ N.
I. C.	+		10	00	Slow	+		9	07		90 00 00
		52	30	00	G. M. T.		9	26	13	P. D.	67 00 03
Dip	−		5	48							
		52	24	12	Sid. time		18h	40m	49s		
Ref.	−			45	Cor.	+		1	33		
True alt.		52	23	27	Cor. sid. time		18	42	22		

Alt.		52°	23′	27″		
Lat.		51	30	00	Sec.	.20585
P. D.		67	00	03	Cosec.	.03597
		2)170	53	30		
½ sum		85	26	45	Cos.	8.89983
Alt.		52	23	27		
Rem.		33	03	18	Sin.	9.73675
						2)18.87840
		2h	07m	36s =	Sin.	9.43920
Tab. cor.	+			3		
Star's H. A.		2	07	39 E.	4h = 60°	
Star's R. A.		2	01	39	14m = 3 30′	
R. A. M.		23	54	00	35s = 8 45″	
Sid. time		18	42	22	Long. 63 38 45 W.	
L. M. T.		5	11	38 P. M.		
G. M. T.		9	26	13 P. M.		
Long.		4	14	35 W.		

New York,

Mr. H. Louderbough.

At my two dry docks at the foot of Stanton St., E. R., I have applied a considerable quantity of your New Jersey Copper Paint, and I must say that my customers and myself have been greatly pleased with it, and in my judgment I believe New Jersey "leads them all." JAMES SHEWAN.

Port Richmond,

Mr. H. Louderbough.

Dear Sir.—After a test of two seasons of your New Jersey Copper Paint with others, we are free to confess in our judgment New Jersey "leads them all." Our customers also give your Paint this strong endorsement.

I remain, yours, &c.,
McWILLIAMS, BURLEE & CO.
Owners Marine Slip.

St. Louis, Mo.,

Harry Louderbough.

Dear Sir.—Last year I purchased your "New Jersey" Yacht Red Copper Paint for my yacht. I put the paint on under adverse conditions, the weather was cold and frosty and my boat not thoroughly dry, just before launching I put on another coat. I took my boat out to-day and was surprised to find how excellently the paint had worn, it is simply "all right." Very respectfully,
MAX C. STARKLOFF, M. D.

Greenpoint, L. I.,

Mr. H. Louderbough.

Dear Sir.—Having applied the New Jersey Yacht Copper for yachts, I do not hesitate to say it is a very superior Paint for yachts' bottoms, being very smooth. It is so finely ground that it makes a good sailing bottom. I remain, yours, etc.,
FRED. C. BEEBE.

Example: January 2, 1902, A. M. Latitude by account 33° 20′ N. The observed altitude of the star *a* Canis Minoris (Procyon) was 21° 41′ 00″ west of the meridian. Time by chronometer 7h 56m 03s A. M., and slow 8m 14s. Height of eye 45 feet. I. C. 30′ +.

Obs. alt.	21°	41′	00″	Chro.		7h	56m	03s	Dec.	5°	28′	34″ N
I. C.	+	30	00	Slow	+		8	14		90	00	00
	22	11	00	G. M. T		8	04	17	P. D.	84	31	26
Dip	—	6	36									
	22	04	24	Sid. time		18h	40m	49s				
Ref.	—	2	23	Cor.	+		3	18				
True alt.	22	02	01	Cor.sid.time		18	44	07				

Alt.	22°	02′	01″			
Lat.	33	20	00	Sec.		.07806
P. D.	84	31	26	Cosec.		.00199
	2)139	53	27			
½ sum	69	56	43	Cosine		9.53520
Alt.	22	02	01			
Rem.	47	54	42	Sin.		9.87047
						2)19.48572
	4h	28m	40s	— Sin.		9.74286
Tab. cor.	+		01			
Star's H. A.	4	28	41 W.			
" R. A.	7	34	10			
R. A. M.	12	02	51			
Sid. time.	18	44	07			
L. M. T.	17	18	44 Ast.			
	12	00	00			
L. M. T.	5	18	44 A. M.			
G. M. T.	8	04	17 A. M.			
Long.	2	45	33 W.			

2h	=30°
45m	=11 15′
33s	= 8 15″
Long.	41 23 15 W

TESTIMONIALS FOR

"New Jersey" Yacht Red and Green Copper Paint.

New York,

H. Louderbough, Esq.,

Dear Sir.—Having sailed yachts of my own and also those of many other people for the past thirty years I would say that in all my experience I have never had so much satisfaction as when I had "New Jersey" Red Copper Paint on the bottom of my yacht, it is a sure anti-fouler, besides being very smooth, making a fine sailing bottom. Last spring I painted the catboat "Caco" with your "New Jersey" Yacht Red Copper Paint and when I took her out of the water in November, she was as smooth as I could want, not a barnacle on her.

Yours truly,
CAPT. G. E. CORDEAUX.

City Island, N. Y.,

Mr. H. Louderbough.

Dear Sir.— I have used the New Jersey Red Copper which you prepare specially for yachts at my Railway the past season, and can cheerfully testify to its merits, it being so thoroughly ground, and its smooth surface has made it a very popular Paint with yachtsmen. I remain, yours, &c.,
A. ROBINSON.

Fall River, Mass.,

Mr. H. Louderbough.

Dear Sir.—In our construction plant and Marine Railways, we have been extensive users of your Yacht Paint Specialties, and in their use results have both pleased our customers and ourselves, and we can cheerfully give them our endorsement.

Yours truly, READ BROTHERS.

Gloucester, Mass.,

Mr. H. Louderbough.

Dear Sir.—I have sold and applied for several years, your "New Jersey" and Yacht Red Copper Paints as a painter. I have come in contact with many paints, but none that has given me the satisfaction your Paint has done. Its consistency is about right, being neither too thick nor too thin, it enters the pores of the wood freely and at the same time gives a good coating on the outside as a protection against fouling. I am, yours truly,
D. A. MITCHELL.

Tottenville, N. Y.,

Mr. H. Louderbough.

Dear Sir.—In the use of Copper Paints, one comes in contact with many brands; and in regards to your productions of New Jersey Copper Paint and Yacht Red and Yacht Green Copper Paints, I have always found them great favorites, as their pronounced qualities make them the most popular and the best Anti-Fouling Paints manufactured.

Yours truly, W. H. SMITH.

Brooklyn, N. Y.,

Mr. H. Louderbough.

Dear Sir.—At our boat house we have used your New Jersey Red Copper Paint, specially ground for yachts, on our new boats, and find it to be a superior Paint, in fact the best we have ever used, and we can recommend it to any owners of yachts.

We remain, respectfully,
WALLIN & GORMAN.

Latitude by Altitude of the Pole Star.

Observe an altitude at any time and correct it for instrumental error, dip and refraction and note the time by chronometer. To the local mean time add the sideral time from page II of the Nautical Almanac and the correction from table 9 corresponding to the Greenwich mean time. The result will be local sideral time and from this subtract the star's right ascension to get the star's hour angle. If the local sideral time is less than the star's right ascension increase it by 24 hours to make subtraction possible. Covert the hour angle into arc and if more than 12h. reject 180°. If the time of observation is noted by the ship's clock on apparent time it must be corrected for any change of longitude made since last regulated and the sun's right ascension from page I of the Nautical Almanac is used in place of the sideral time and correct it by multiplying the hourly difference by the Greenwich time. The sum of the logarithm cosine of the hour angle and the common logarithm of the polar distance in miles will be the correction to be applied to the true altitude which will give the latitude. Between 6 hours and 18 hours it is additive. Less than 6 hours and more than 18 hours it is subtractive.

Example: May 5, 1902. Time by ship's clock on apparent time 4h. 07m. 00s. A.M. The observed altitude of the Pole Star was 37° 10′ 30″. Longitude by account 59° 59′ 45″ W. Since the clock was last set on apparent time the ship changed the longitude 1° 58′ 30″ W. Height of eye 18 feet.

Clock time (ast.) 4h.		16h.	07m.	00s.	Sun's R. A.		2h.	42m.	29s.	H. D.	9s.6
Dif. long. 1° 58′ 30″	= —		7	54	Cor.	+		3	12	G. A. T.	× 20h.
L. A. T.		15	59	06	Cor. R. A.		2	45	41	Cor. 3m. 12s.	= 192.0
Long. 59° 59′ 45″	= +	3	59	59	Dec.			88°	47′	04″ N.	
G. A. T.		19	59	05				90			
					P. D. 72′.9	=		1	12	56	

L. A. T.		15h.	59m.	06s.	H. A. 17h. 21m. 23s.	= 80°	20′	45″ Cos. 9.22452
Sun's R. A.	+	2	45	41	P. D. 72′.9			+ 1.86273
L. S. T.		18	44	47	Cor. 12′ 13″		= 12′.225	= 1.08725
Star's R. A.	—	1	23	24				
" H. A.		17	21	23				

Obs. alt.		37°	10′	30″	
Dip	—		4	09	
		37	06	21	
Ref.	—		1	17	
True alt.		37	05	04	
Cor.	+		12	13	
Lat.		37	17	17	N.

Example: April 19, 1902. The observed altitude of the Pole Star was 42° 03′ 20″. Local apparent time 4h. 57m. 00s. A.M. Longitude by account 37° 30′ W. Height of eye 40 feet.

L. A. T. 18th		16h.	57m.	00s.	Sun's R. A.		1h.	42m.	11s.	H. D.	9s.27
Long. 37° 30′	= +	2	30	00 W.	Cor.	+		3	00	G. A. T.	× 19.4
G. A. T.		19	27	00			1	45	11		3708
											8343
L. A. T.		16h.	57m.	00s.							927
Sun's R. A.		1	45	11						Cor. 3m.	= 179.838
L. S. T.		18	42	11	Dec.			88°	47′	04″	
Star's R. A.	—	1	23	24				90			
" H. A.	=	17	18	47	P. D. 72′.9	=		1	12	56	

Obs. alt.		42°	03′	20″	H. A. 17h. 18m. 47s.	= 79°	41′	45″	log. cos.	9.25256
Dip	—		6	12	P. D. 72′.9				"	1.86273
		41	57	08	Cor. 13′.04	= 0°	13′	02″	= "	1.11529
Ref.	—		1	05						
True alt.		41	56	03						
Cor.	+		13	02						
Lat.		42	09	05	N.					

Example: December 6, 1902. The observed altitude of the Pole Star was 38° 10′ 30″. Local mean time 8h. 04m. 00s. P.M. I. C.+4′ 10″. Longitude by account 67° 30′ W. Height of eye 30 feet.

L. M. T.		8h.	04m.	00s.	
Long. 67° 30′	= +	4	30	00	W.
G. M. T.		12	34	00	

L. M. T.		8h.	04m.	00s.
Sid. T.		16	57	20
Cor. table 9			2	04
L. S. T.		1	03	24
Star's R. A.	—	1	23	24
" H. A.		23	40	00

Obs. alt.		38°	10°	30″	
I. C.	+		4	10	
		38	14	40	
Dip	—		5	22	
		38	09	18	
Ref.	—		1	14	
True alt.		38	08	04	
Cor.	—	1	12	37	
Lat.		36	55	27	N.

Dec.		88°	47′	04″ N.
		90	00	00
P. D. 72′.9	=	1	12	56

H. A. 23h. 40m. 00s. = 175° 00′ log. cos. 9.99834
P. D. 72′.9 " 1.86273
Cor. 72′.62 = 1° 12′ 37″ = " 1.86107

Example: January 8, 1902. The observed altitude of the Pole Star was 20° 08′ 00″. G.M.T. 1h. 40m. 00s. A.M. Longitude by account 60° 00′. E. Height of eye 35 feet.

G. M. T. 7th		13h.	40m.		
Long. 60°	= +	4	00		E.
L. M. T.		17	40		

L. M. T.		17h.	40m.	00s.
Sid. T.		19	04	28
Cor. table 9			2	15
L. S. T.		12	46	43
Star's R. A.	—	1	23	24
" H. A.		11	23	19

Obs. alt.		20°	08′	00″	
Dip	—		5	48	
		20	02	12	
Ref.			2	39	
		19	59	33	
Cor.	+	1	11	58	
Lat.		21	11	31	N.

Dec.		88°	47′	04″ N.
		90		
P. D. 72′.9	=	1	12	56

H. A. 11h. 23m. 19s. = 170° 49′ 45″ log. cos. 9.99442
P. D. 72′.9 " 1.86273
Cor. 71′.97 = 1° 11″ 58″ = " 1.85715

Example: January 25, 1902. The observed altitude of the Pole Star was 42° 17′ 30″. Time by the ship's clock on apparent time 4h. 47m. 00s. A.M. Longitude by account 51° 30′ W. Since the clock was last regulated the ship made a difference of longitude 2° 40′ east. Height of eye 18 feet.

Clock time (ast.) 24th		16h.	47m.	00s.	
Dif. long.	+		10	40	E.
L. A. T.		16	57	40	
Long.	+	3	26	00	W.
G. A. T.		20	23	40	

Sun's R. A.		20h.	23m.	39s.
Cor.	+		3	34
Cor. R. A.		20	27	13

H. D. 10s.5
20.4
420
2100
Cor. 3m. 34s = 214.20

Dec.		88°	47′	04″
		90		
P. D. 72′.9	=	1	12	56

L. A. T.		16h.	57m.	40s.
Sun's R. A.	+	20	27	13
L. A. T.		13	24	53
Star's R. A.	—	1	23	24
" H. A.		12	01	29

Obs. alt.		42°	17′	30″	
Dip	—		4	09	
		42	13	21	
Ref.	—		1	04	
True alt.		42	12	17	
Cor. 72′.9 =	+	1	12	54	
Lat.		43	25	11	N.

H. A. 01m. 29s. = 0° 22′ 15″ Cos. 9.99999
P. D. 72′.9 + 1.86273
Cor. 1° 12′ 54″ = 72′.9 = 1.86272

Longitude by Observation of the Moon.

Observe an altitude as near the prime vertical as possible and note the time by chronometer. As the moon moves quite fast it is not necessary to use the tangent screw. When rising dip the limb and when falling clamp the instrument when the limb is a trifle above the horizon and note the time of contact which must be expressed astronomically.

Take out the sidereal time for the astronomical date and to it apply the correction from table 9 for the Greenwich time. The moon's right ascension and declination are taken out for the hour of the Greenwich date and corrected for the minutes past the hour. The remainder of the work is the same as finding longitude by a fixed star.

In the following problems the correction for the semi-diameter has been neglected because in practise its use is not a necessity; but the necessary tabular corrections for the parallax from table 24 have been considered.

Example: August 15, 1902, *P.M.* The observed altitude of the moon's lower limb was 10° 15′ 00″ E. Time by chronometer 9h. 30m. 07s. A.M. and fast 5m. 14s. Latitude by account 27° 45′ N. Height of eye 26 feet. I. C. + 2′ 15″.

Chro. 14th		21h.	30m.	07s.
Fast	—		5	14
G. M. T.		21	24	53

Obs. alt. L. L.		10°	15′	00″
I. C.	+		2	15
S. D. noon 15th	+		14	51
		10	32	06
Dip	—		5	00
App. alt.		10	27	06
Par. and ref.	+		48	25
True alt.		11	15	31

Sid. time 14th		9h.	27m.	53s.
Cor. Table 9	+		3	31
Cor. sid. time		9	31	24

Moon's R. A. 14th		18h.	31m.	05s.
Cor.	+			52
Cor. R. A.		18	31	57

Moon's dec. 14th		18°	30′	44″ S.
Cor.	—		1	03
Cor. dec.		18	29	41
	+	90		
P. D.		108	29	41

M. D.	2s.1
Min.	× 24.9
	249
	498
Cor. 52s.	= 52.29

M. D.	2″.53
Min.	× 24.9
	2277
	1012
	506
Cor. 1′ 03″	= 62.997

Alt.		11°	15′	31″	
Lat.		27	45	00	
P. D.		108	29	41	
	2)	147	30	12	
½ sum		73	45	06	
Alt.		11	15	31	
Rem.		62	29	35	

Sec.		.05306			
Cosec.		.02303			
Cos.		9.44685			
Sin.		9.94790			
	2)	19.47084			
Sin.		9.73542			

H. A.		4h.	23m.	32s.	E.
Moon's R. A.		18	31	57	
R. A. M.		14	08	25	
Sid. time	—	9	31	24	
L. M. T. 15th		4	37	01	
G. M. T. 14th		21	24	53	
Long.		7	12	08	E.

7h.	=	105°			
12m.	=	3	00′		
8s.	=		2	00″	
Long.		108	02	00	E.

Mobile, Ala.

H. Louderbough.

Dear Sir.—At our Marine Railways we have, for several years, used very freely large quantities of your "New Jersey" Copper Paint and it is very pleasing to note the general satisfaction with which our customers receive it. In our Southern waters, vessels foul quickly and we consider your production one of the best preventives that we have ever used.

Yours respectfully
ROBT. MIDDLETON, Manager.

Hoboken, N. J.

Mr. Harry Louderbough.

Dear Sir.—Our acquaintance with your brands of "New Jersey" Copper Paints, for wooden vessels, and your Anti-Corrosive and Anti-Fouling Paints for iron vessels, has run over a period of many years, and the results have been more than satisfactory to us and our patrons. Their vessels have not only been protected from barnacles and grass, but the surface, owing to the care exercised in manufacturing the Paints, has been very smooth, making a good sailing bottom.
WILLADSEN DRY DOCK CO.

The Most Used Because the Best "NEW JERSEY" MARINE PAINTS

Example. November 21, 1902, *A.M.* The observed altitude of the moon's lower limb was 11° 14′ 00″ W. Time by chronometer 2h. 15m. 04s. P.M. and slow 2m. 17s. Latitude by account 31° 15′ N. Height of eye 18 feet.

Chro. 21st		2h.	15m.	04s.
Slow	+		2	17
G. M. T.		2	17	21
Obs. alt. L. L.		11°	14′	00″
S. D. noon 21st	+		16	03
		11	30	03
Dip	—		4	9
App. alt.		11	25	54
Par. and ref.	+		52	59
True alt.		12	18	53

Sid. time 21st		15h.	58m.	12s.
Cor.	+			23
Cor. sid. time		15	58	35
Moon's R. A. 21st		9h.	19m.	10s.
Cor.	+			39
Cor. R. A.		9	19	49

Moon's dec. 21st		10°	38′	51″ N.
Cor.	—		2	42
Cor. dec.		10	36	09
		90		
P. D.		79	23	51

Alt.		12°	18′	53″
Lat.		31	15	00
P. D.		79	23	51
		2)122	57	44
½ sum		61	28	52
Alt.		12	18	53
Rem.		49	09	59

Sec. .06808
Cosec. .00748
Cos. 9.67893
Sin. 9.87887
2)19.63336
Sin. 9.81668

H. A.		5h.	27m.	46s.	W.
Moon's R. A.		9	19	49	
R. A. M.		14	47	35	
Sid. time	—	15	58	35	
L. M. T. 20th		22	49	00	
G. M. T. 21st		2	17	21	
Long.		3	28	21	W.

3h.	=	45°		
28m.	=	7	00′	
21s.	=		5	15″
Long.		52	05	15 W.

M. D. 2s.27
Min. × 17.3
681
1589
227
Cor. 39s. = 39.271

M. D. 9″.36
Min. × 17.3
2808
6552
936
Cor. 2′ 42″ = 161.928

Sumner's Method.

While this method of determining the longitude, latitude and true azimuth at sea is used by navigators generally, few are familiar with its history, and for that reason a brief account of it is given here.

Capt. Thomas H. Sumner was an American by birth, and at the time he discovered this important method of determining a ship's position at sea, which has proved so valuable to navigators, he commanded an American ship.

On November 25, 1837, he sailed from Charleston, S. C., for Greenock, and when off the Irish coast and the latitude being uncertain, he obtained the observations which have made his name immortal among the navigators of every nation, for he has given them one more method of finding their position and the true azimuth of any heavenly body.

EXPLANATION.

Observe an altitude of the sun and to it apply the usual corrections, noting the time by chronometer. Supposing the latitude by account to be uncertain, assume two latitudes, say 5 to 30 miles or more, each side of that by account. Find the longitude in the usual way, using both of the assumed latitudes, and the result will be two longitudes. Place them on the chart and join them by a line which is called the first line of position. It is safe to say that the ship is somewhere on that line. When the sun's azimuth has changed about 20° or 30°, observe another altitude, correcting it and noting the time by chronometer. Use the assumed latitudes as before and obtain two longitudes, which are to be placed on the chart and joined by a line as in the first observation. Where the two lines cross, will be the ship's position, giving the latitude and longitude. If the ship has sailed in the meantime, move the first line of position a distance, east or west as the case may require, corresponding to the departure made. The true azimuth at the time of each observation will be represented by a line at right angle to the line of position.

This method is used with observations of any heavenly body in the same manner as with the sun. In fact, altitudes of two different stars may be observed at the same time, and the two lines of position be found at once.

Example: June 11, 1902, A. M. The observed altitude of the sun's lower limb was 22° 36′ 20″. Time by chronometer 10h 51m 54s A. M. Some time after that observation the observed altitude of the sun's lower limb was 64° 56′ 40″. Time by chronometer 2h 21m 53s P. M. The chronometer was fast 2m 40s. Index correction + 3′ 20″. Height of eye 20 feet. Latitude by account 35° 00′ N. Assume latitudes 15′ each side of that by account and find the latitude, longitude and sun's true azimuth by projecting the Sumner lines on the chart.

FIRST ALTITUDE.

Obs. alt. L. L.		22°	36′	20″	Dec.	23°	02′	33″ N.	H. D. 11′.18
I. C.	+		3	20	Cor.	—		13	× 1h.2
		22	39	40	Cor. dec.	23	02	20	2236
Semi-diam.	+		15	46		90	00	00	1118
		22	55	26	Pal. dist.	66	57	40	Cor. 13″ —13″.416
Dip	—		4	23					
		22	51	03					
Ref.	—		2	17					
		22	48	46	Equa. of time	0m	46s.35		H. D. 0s.498
Par.	+			08	Cor.	+		.60	× 1h.2
True alt.		22	48	54	Cor. equa. of time	0		46.95	996
									498
									Cor. 0s.60 =.5976

Chro. time	10h	51m	54s	A. M.
Fast	—	2	40	
G. M. T.	10	49	14	

A

Alt.		22°	48′	54″				
Lat.		35	15	00	Log. secant	.08797		
P. D.		66	57	40	" cosecant	.03609		
		2)125	01	34				
½ sum		62	30	47	" cosine	9.66422		
Alt.		—22	48	54				
Rem.		39	41	53	" sine	9.80533		
						2)19.59361		
		6h	49m	52s	= sine	9.79680		
Tab. cor.	—			06				
L. A. T.		6	49	46		4h	=60°	
Equa. of time	—			47		00m	= 0	00′
L. M. T.		6	48	59	A. M.	15s	=	3 45″
G. M. T.		10	49	14	A. M.	Long.	60	03 45 W
Long.		4	00	15				

B

Alt.		22°	48′	54″				
Lat.		34	45	00	Log. secant	.08531		
P. D.		66	57	40	" cosecant	.03609		
		2)124	31	34				
½ sum		62	15	47	" cosine	9.66784		
Alt.		—22	48	54				
Rem.		39	26	53	" sine	9.80304		
						2)19.59228		
		6h	50m	16s	= sine	9.79614		
Tab. cor.	+			03				
L. A. T.		6	50	19				
Equa. of time	—			47		3h	=45°	
L. M. T.		6	49	32		59m	=14	45′
G. M. T.		10	49	14		42s	=	10 30″
Long.		3	59	42		Long.	59	55 30 W.

SECOND ALTITUDE.

Obs. alt. L. L.		64°	56′	40″	Dec.		23°	02′	33″ N.	H. D.	11″.18
I. C.	+		3	20	Cor.	+			26	G. M. T.	× 2h.3
		65	00	00	Cor. dec.		23	02	59		3354
Semi-diam.	+		15	46			90	00	00		2236
		65	15	46	Pol. dist.		66	57	01	Cor. 26″	= 25.714
Dip	—		4	23							
		65	11	23							
Ref.	—			27							
		65	10	56							
Par.	+			04	Equa. of time		0m	46s.35		H. D.	0s.498
True Alt.		65	11	00	Cor.	—		1	.15	G. M. T.	2h.3
					Cor. equa. of time		0	45	.20		1494
Chro. time		2h	21m	53s P. M.							996
Fast	—		2	40						Cor. 1s.15	= 1s.1454
G. M. T.		2	19	13							

C

Alt.		65°	11′	00″					
Lat.		35	15	00	Log.	secant	.08797		
P. D.		66	57	01	"	cosecant	.03613		
		2)167	23	01					
½ sum		83	41	30	"	cosine	9.04093		
Alt.	—	65	11	00					
Rem.		18	30	30	"	sine	9.50167		
							2)18.66670		
		10h	20m	32s	=	sine	9.33335		
Tab. cor.	—			04					
L. A. T.		10	20	28					
Equa. of time	—			45			3h	=	45°
L. M. T.		10	19	43	A. M.		59m	=	14 45′
G. M. T.		2	19	13	P. M.		30s	=	7 30″
Long.		3	59	30			Long.		59 52 30 W.

D

Alt.		65°	11′	00″					
Lat.		34	45	00	Log.	secant	.08531		
P. D.		66	57	01	"	cosecant	.03613		
		2)166	53	01					
½ sum		83	26	30	"	cosine	9.05771		
Alt.	—	65	11	00					
Rem.		18	15	30	"	sine	9.49596		
							2)18.67511		
		10h	19m	28s	=	sine	9.33755		
Tab. cor.	+			01					
L. A. T.		10	19	29			4h	=	60°
Equa. of time	—			45			00m	=	0 00′
L. M T.		10	18	44	A. M.		29s	=	7 15″
G. M. T.		2	19	13	P. M.		Long.		60 07 15 W
Long.		4	00	29					

Having placed these longitudes on the chart in their respective latitudes, two lines of position are obtained. The result of the first observation is the line A B and is crossed by the line C D, which is the result of the second observation, in latitude 35° 0′ 0″ N., and longitude 60° 0′ 0″ W., which is the ship's position. The sun's true azimuth is at right angle to these lines of position, and at the time of the first observation it was N. 77° E., and at the time of the second observation N. 112° E. Had the compass azimuth been obtained at the instant of each observation, the compass error and deviation could readily be determined as explained on page 67.

Hoboken, N. J.

Mr. H. Louderbough.

Dear Sir:—For a number of years we have used the productions of R. F. Seaman & Co., consisting of "Iron Crown Paint" for Iron Vessels, Anti-Corrosive and Anti-Fouling Paints and Wetterstedt Copper Paint, and since you have purchased this business, we are free to note, that your manufacturing of these Paints has made them better as they run more uniform than they did, and are easier to apply, being ground better.

Yours truly,

THE TIETJEN & LANG DRY DOCK CO.

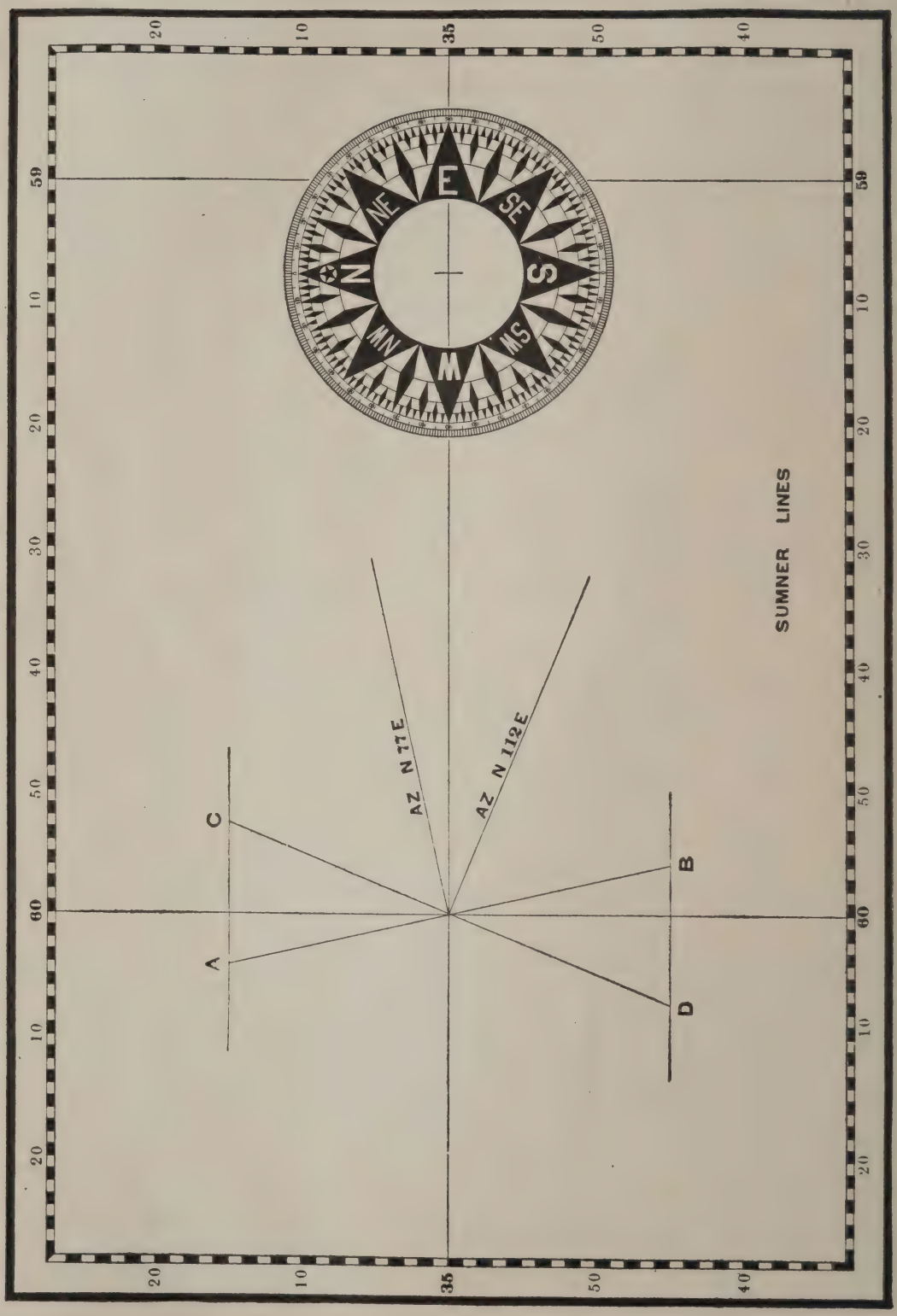
Gloucester, Mass.

Mr. H. Louderbough.

Dear Sir:—As painters of Vessels hauling on the Railways of Gloucester, after several years' trial of the many manufactured copper Paints, we can endorse your "New Jersey Copper Paint to be without question, the best Paint we have ever used; it being finely ground, making a very smooth bottom, and also a good Anti-Fouler; these two good qualities have made it a great favorite with our customers and ourselves. I remain,

Yours truly,

JOS. B. MAGUIRE & SON.


E
SE
S
SW
W
NW
N
NE
SUMNER LINES
AZ N 77E
AZ N 112E
A
B
C
D

No Settling

PERFECT SHIP BLACK

The Most Durable and Blackest Paint Made.

FOR STEAMSHIPS.

FOR VESSELS.

READY MIXED.

HARRY LOUDERBOUGH, Prop.

NEW JERSEY PAINT WORKS of JERSEY CITY, N. J.

GUARANTEED

The following plates will illustrate the various uses of the method for fixing a ship's position and in some cases it will be noticed that the desired result is found by very little additional calculation which must add to its value. To plot the lines of position it is more convenient and practical to use a whole degree of latitude in place of the usual 20 or 30 miles and by placing a sheet of paper on the proper part of the chart and ruling the parallels of latitude and the meridians, no marks will be on the chart. The problem illustrated by Plate 1 is the one most generally used.

PLATE No. 1.

Latitude by account 29° 22′ N. An observation of the sun worked with latitude 30° gave the longitude 77° 16′ W., and the same observation worked with latitude 29° gave the longitude 77° 32′ W. The two longitudes are placed on the chart in their proper latitudes and a solid line connecting them is called the first line of position. The true azimuth will be at right angles from this line, which, in this case, shows the true bearing N. 103° E. After the azimuth had changed a proper quantity another observation of the sun was obtained and worked with latitude 30° gave the longitude 77° 23′ W., and the same observation worked with latitude 29° gave the longitude 78° 46′ W. These two longitudes are placed on the chart and the second line of position found in the same manner as the first, and the true azimuth being at right angles to the line of position is N. 140° E.

From the first observation the ship ran W. by S. (true) for 22 miles and for that reason it is necessary to move the first line of position a corresponding distance in that direction. To do this transfer the course to any part of the first line of position and measure 22 miles and then transfer the first line of position to the point and rule a broken line, and where this broken line crosses the second line of position will be the ship's position at the time of the second observation: latitude 29° 45′ N., and longitude 77° 44′ W. Transfer the course to the position thus found and rule a broken line to the first line of position, and the intersection will be the ship's position at the time of the first observation: latitude 29° 49′ N., and longitude 77° 19′ W.

BEST TESTIMONIALS.
HIGHEST MEDALS.

South Brooklyn.

Harry Louderbough, Esq.

New Jersey Paint Works, Jersey City, N. J.
Dear Sir.—Replying to yours, will say that we have used your Copper and Seam Paints, and same have given entire satisfaction.

Yours respectfully,
TRUNDY & MURPHY

Port Clyde, Me.

Mr. H. Louderbough.

Dear Sir.—What New Jersey Copper Paint we have used at our Railway at Port Clyde has greatly pleased us, it is so easy to apply, being finely ground, and it leaves a nice bottom. We are thoroughly convinced it is a superior Paint.

Yours respectfully,
WASHBURN MARINE RY. CO.

North Tisbury, Mass.

Mr. H. Louderbough.

Dear Sir.—I have just had an experience that to my mind bears out fully your claims that "New Jersey" Copper Paint does protect a vessel's bottom. My yacht was sunk for about a year, when the mast worked loose and come to the top of the water, being held by the rigging. It was owing to this that I located her. She was lifted and the bottom, painted with "New Jersey" Copper Paint, was in splendid condition, while the remaining frame and woodwork was honeycombed by the salt water worm and ruined. My former experiences with your Copper Paint, giving a smooth and good sailing bottom, added to this last experience, makes me a great champion for your paint, I shall always give it the preference over all others.

Yours respectfully,
OTIS B. LUCE.

New Jersey.

Mr. H. Louderbough.

Dear Sir.—At Gokey's Dry Dock to-day I lifted schooner "Thomas L. James," which was painted a year ago with New Jersey Copper Paint. She was as clean as the day she was painted, and I consider your Paint to be the best I have ever used.

Yours, &c., D. N. PEARCE.

Hampton, Va.

Mr. H. Louderbough.

My Dear Sir.—At my Railways, I have used for two seasons, your Wetterstedt Copper Paint, and have found it, next to your "New Jersey" Copper Paint, a very satisfactory Paint, being smooth, making a good sailing bottom, and easy to apply.

Yours truly,
WARREN HALL.

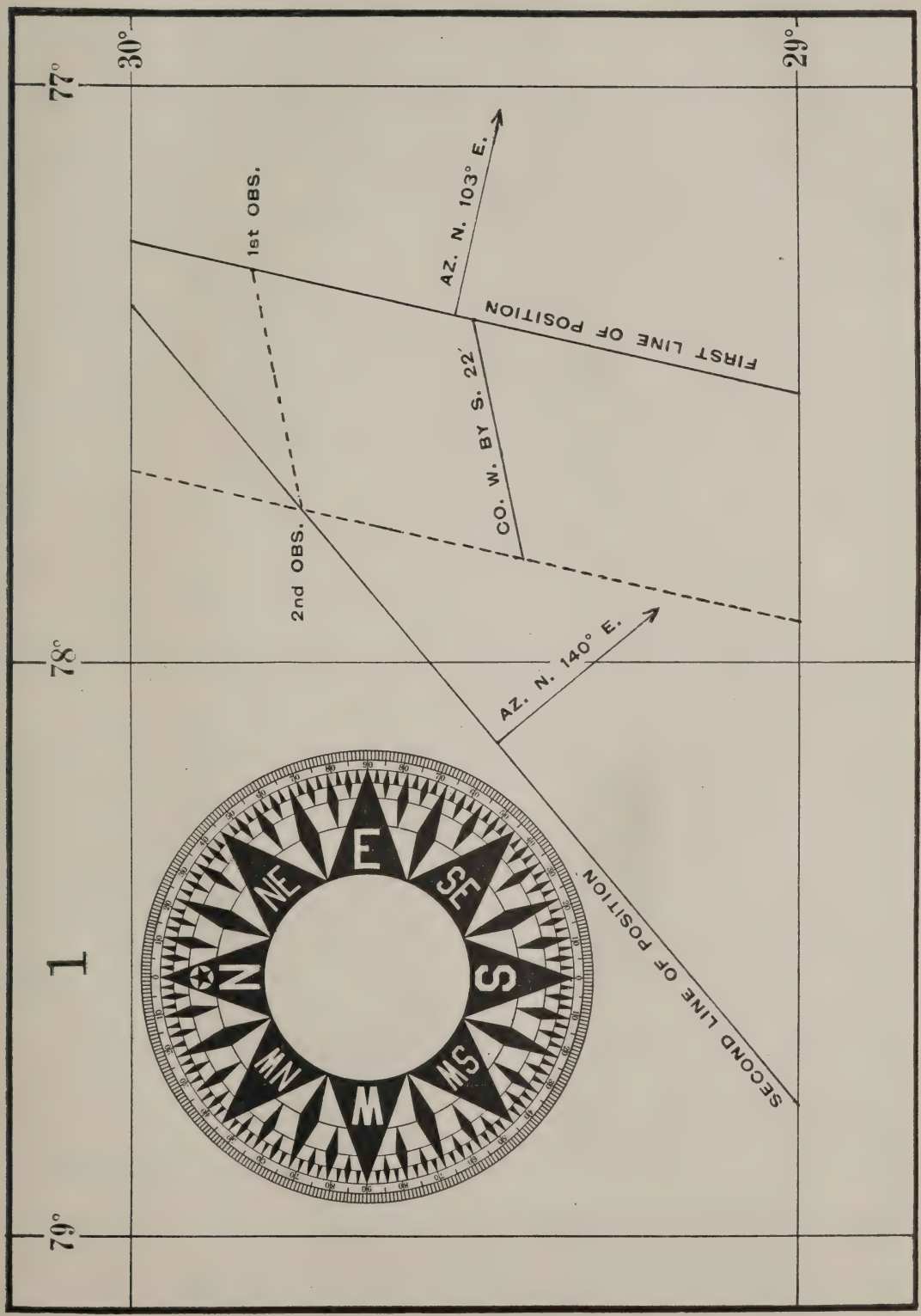

77°
30°
29°
78°
79°
1st OBS.
AZ. N. 103° E.
FIRST LINE OF POSITION
CO. W. BY S. 22′
2nd OBS.
AZ. N. 140° E.
SECOND LINE OF POSITION
1
E
SE
S
SW
M
NW
N
NE

PLATE No. 2.

Latitude by account 29° 36′ N. An observation of the sun worked with latitude 30° gave the longitude 77° 17′ W., and the same observation worked with latitude 29° gave the longitude 77° 35′ W. The two longitudes are placed on the chart in their proper latitudes and the solid line connecting them is called the first line of position. The direction of the line is 14° and the sun's true azimuth will be 90° + 14° = N. 104° E. After the azimuth had changed a proper quantity another observation of the sun was obtained and worked with latitude 30° gave the longitude 77° 43′ W., and the same observation worked with latitude 29° gave the longitude 78° 42′ W. The two longitudes are placed on the chart in their proper latitudes and the solid line connecting them is called the second line of position. The direction of the line is 41° and the sun's true bearing will be 90° + 41° = N. 131° E.

From the first observation the ship was sailed N.W. (true) for 16½ miles. Rule the course and distance from any part of the first line of position and then move the first line of position to the end of the course and rule a broken line. In this problem the lines do not intersect within the assumed latitudes. Extend them until they meet and that point will be the ship's position at the time of the second observation, longitude 77° 31′ W., and latitude 30° 10′ N. To find the ship's position at the time of the first observation, transfer the course sailed to the position by the second observation and rule a broken line, and where it crosses the first line of position will be the position, longitude 77° 17′ W., and latitude 29° 58′ N.

TESTIMONIALS.

New York,

Mr. Harry Louderbough.

Dear Sir.—I have just painted at Tietjen & Lang's Dry Dock, at Hoboken, N. J., the Pilot Boat "James Gordon Bennett," and it affords me great pleasure to give your New Jersey Copper Paint my endorsement. Some years ago I was induced to give your Yacht Red Copper a trial, and it has always proven itself to be the best production for the bottom of a vessel that I have ever used, and it is now generally used by our Pilot Boats in New York Harbor.

JAMES F. BROWN,
Master Pilot Boat "James Gordon Bennet."

Rockland, Me.,

H. Louderbough.

Dear Sir.—We have used the New Jersey Copper Paint at our yard, and were much pleased with its fineness. It being easy to apply and of good covering qualities has convinced us that it is a superior Paint. I remain, yours, etc.

G. A. GILCHRIST.

Little Silver, N. J.,

New Jersey Paint Works,
Jersey City, N. J.

Gentlemen.—I pulled out of water last week, a yacht called the "Peggy," for W. I. Walker of New York. She had not been out in two years, or her bottom scrubbed off, her brass rudder and propeller was covered with barnacles and oysters. The fender piles this boat was tied to was eaten off by the worms and to my surprise, there wasn't a worm hole in the yacht and when we scrubbed her bottom off, we found the red as bright as when we put it on two years ago at Port Monmouth. Yours truly,

J. H. LANGLEY.

R. F. SEAMAN & CO.'S PRODUCTIONS.

Wetterstedt's Copper Paint. **Seam Paint.**
"Iron Crown" Anti-Corrosive Paint—No. 1.
"Iron Crown" Anti-Fouling Paint—No. 2.

Having purchased their trade-marks they are now manufactured by

HARRY LOUDERBOUGH, Inc.

NEW JERSEY PAINT WORKS,

JERSEY CITY, N. J.

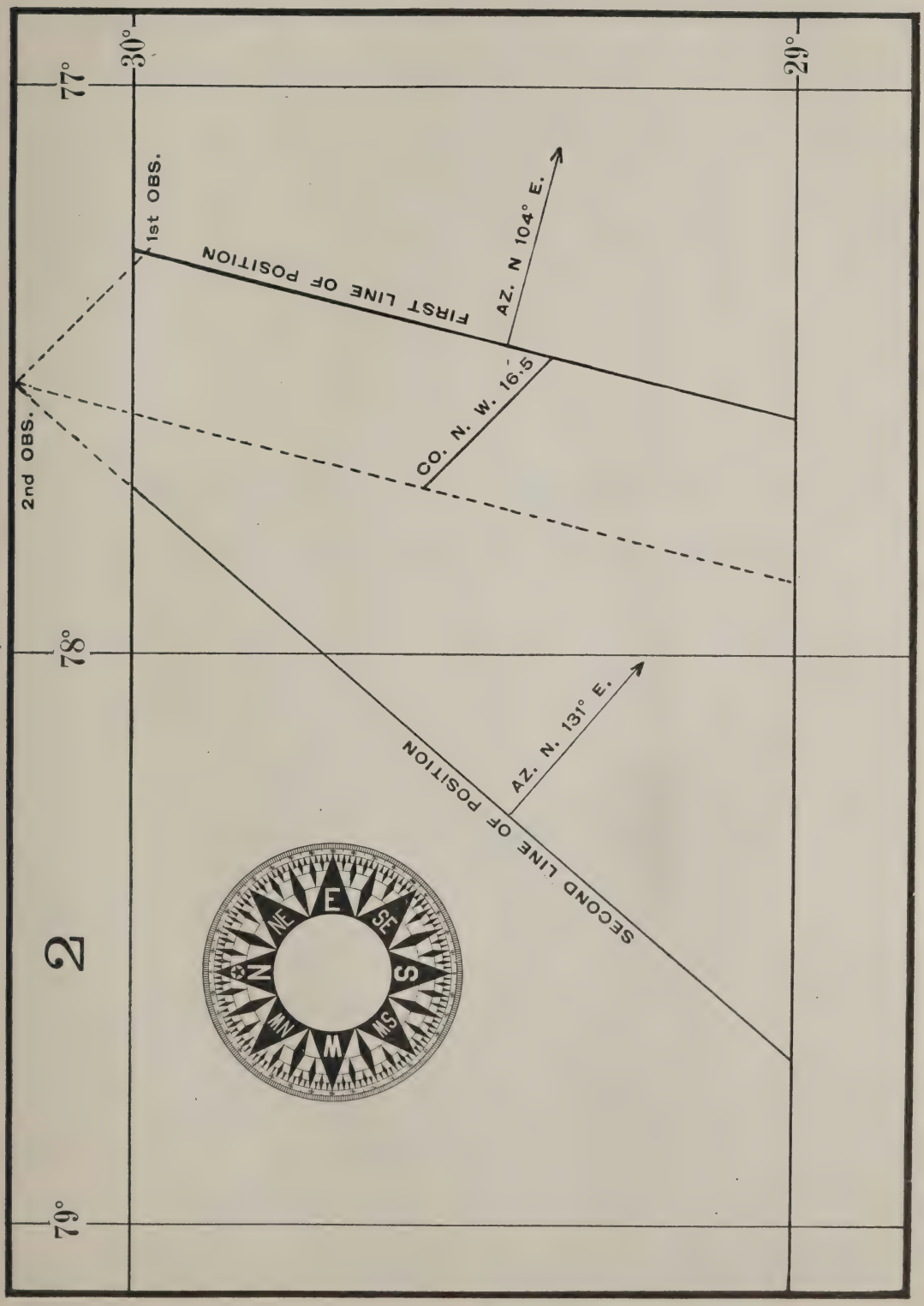

77°
30°
29°
1st OBS.
FIRST LINE OF POSITION
AZ. N 104° E.
CO. N. W. 16·5
2nd OBS.
78°
AZ. N. 131° E.
SECOND LINE OF POSITION
2
E
NE.
SE.
S
N
NW.
M.S.
M
79°

PLATE No. 3.

Latitude by account 29° 15′ N. An observation of the sun gave the longitude 77° 15′ W., and the sun being on the prime vertical or bearing true east the longitude found will be 77° 15′ W., and the line of position will be a north and south solid line. It being understood that an error of a few miles in the latitude is of no consequence when the body bears true east or west. It is readily seen that the object of the second observation is to find the latitude. After the azimuth had changed a proper quantity another observation was obtained, and as the bearing of the body had changed considerably from the prime vertical it is necessary to work it with both latitudes, 30° and 29°. With latitude 30° the longitude found is 77° 05′ W., and with latitude 29° the longitude is 78° 05′ W. The two longitudes are placed on the chart in their proper latitudes and the solid line connecting them is the second line of position. The ship ran west (true) 15 miles. Move the first line of position which is parallel to the meridian 15 miles west (true) and rule a broken line, and where it crosses the second line of position will be the latitude 29° 33′ N.

The direction of the second line of position 40° and the sun's true azimuth will be 90° + 40° = N. 130° E.

BEST TESTIMONIALS ARE GIVEN TO "NEW JERSEY" MARINE PAINTS.

South Norwalk, Conn.,

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:— I have used your copper paint more than twenty years and have found it satisfactory in every case.

Yours truly,

FREDERICK B. BAKER, M.D.

Swampscott, Mass.,

Mr. Harry Louderbough, Jersey City, N. J.

Dear Sir:—We have had good results with your copper paint and continue to use it. Although there are a lot of copper paints in the market, we have tried them and yours has given us the best satisfaction.

Yours very truly,

E. GERRY EMMONS CORPORATION.

Townsend, Va.

Mr. Harry Louderbough. Jersey City, N. J.

Dear Sir:—I have been a vessel man all my life up to the last two years. I have used your "New Jersey" Yacht Red Copper paint and I think there is none better.

Respectfully yours,

O. L. ROOKS.

Fortress Monroe, Va.,

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:—I have used considerable of your line of paints on iron work around the fire rooms and engine rooms on different vessels I have been in charge of and always found it to be first class in every respect.

Yours truly,

WILLIAM M. CHISHOLM.

Norfolk, Va.

Mr. Harry Louderbough, Jersey City, N. J.

Dear Sir:—I have used your paint for many years and know it is absolutely the best.

Yours respectfully,

A. B. LE CATO.

St. Louis, Mo.,

Harry Louderbough, Esq., Jersey City, N. J.

Dear Sir:—You can refer to me at any time regarding the merits of your paints. For years I have used your copper paint and there is not a spot on my hull that is bare. It is the only paint I ever saw that if properly applied will stick in our sand laden Mississippi River waters.

Yours sincerely,

Dr. MAX C. STARKLOFF.

Philadelphia, Pa.,

New Jersey Paint Works, Jersey City, N. J.

Gentlemen:—Would you please send me one of your books on navigation. I am a steady user of your paint on all my boats. I think they are the real thing around a boat.

Yours very truly,

FRANK NELSON.

San Francisco, Cal.,

Harry Louderbough, Esq., Jersey City, N. J.

Dear Sir:—I want to say a word for your New Jersey Copper Paint. In the month of January 1905, my vessel was painted with it. We sailed that month and put in the spring months in the Tropics; in the Summer and Fall went into the Arctic Ocean, altogether a period of twenty-one months, and on my return to San Francisco found her bottom clean.

Yours respectfully,

Captain F. L. RAYMOND.

Conneaut, Ohio,

Mr. Harry Louderbough, Jersey City, N. J.

Dear Sir:—Upon laying our boat up for the winter we found the green bottom covered last Spring with one coat of your New Jersey Green Copper Paint to be in prime condition, quite superior to any green we have heretofore used for the boat bottoms.

Yours truly,

D. CUMMINS CO.

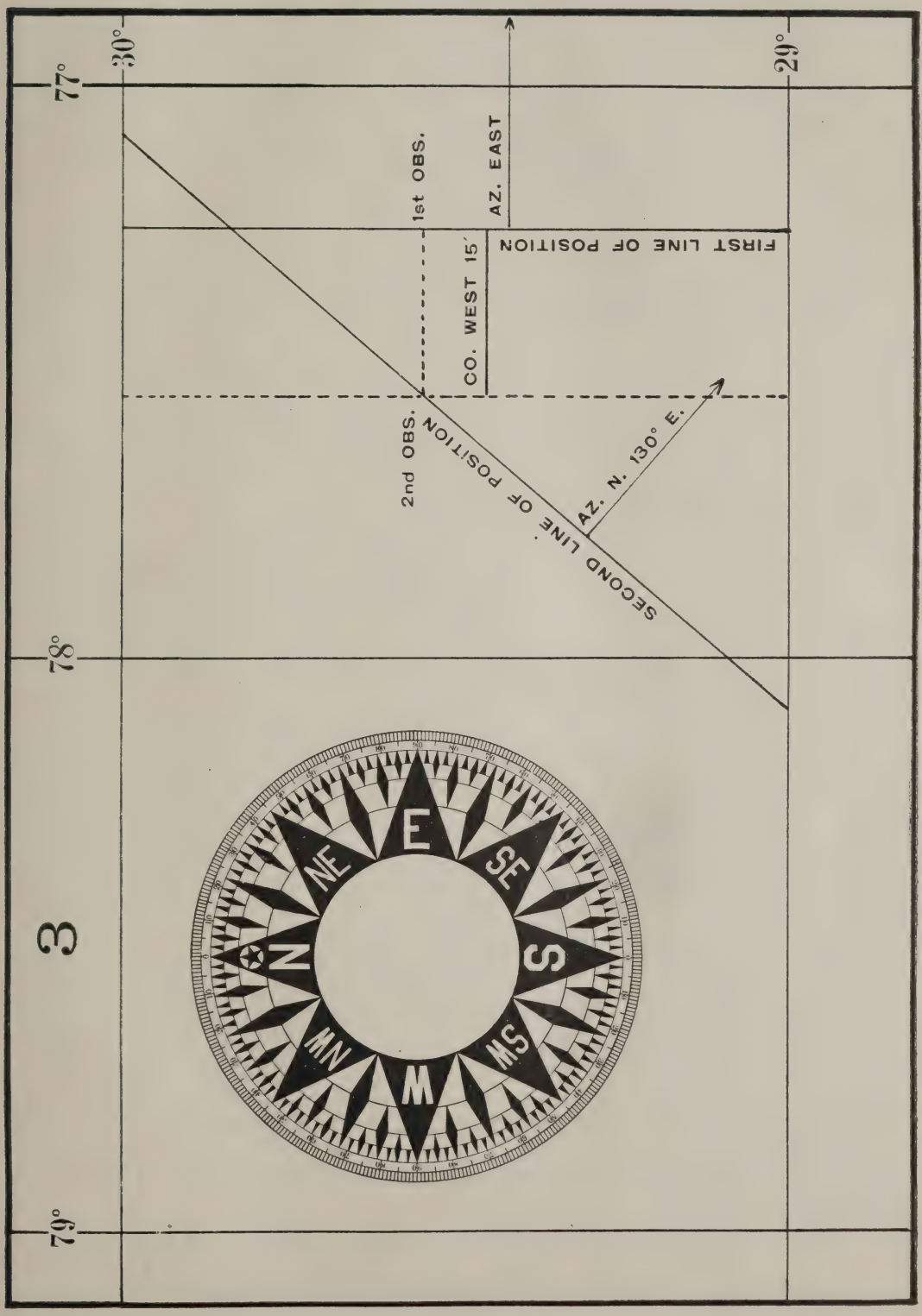

77°
30°
29°
1st OBS.
AZ. EAST
FIRST LINE OF POSITION
CO. WEST 15'
2nd OBS.
SECOND LINE OF POSITION
AZ. N. 130° E.
78°
3
79°
E
SE
S
SW
M
NW
N
NE

PLATE No. 4.

Latitude by account 29° 23′ N. An observation of the sun worked with latitude 30° gave the longitude 77° 15′ W. and the same observation worked with latitude 29° gave the longitude 78° 44′ W. In this case the next observation was the latitude by meridian altitude which gave the latitude 29° 45′ N.. and a line of position east and west which serves the full purpose. From the first observation the ship ran N.W. by W. (true) 15 miles. The first line of position being moved properly gives the noon position in longitude 78° 04′ W., and latitude 29° 45′ N.

Note the Positive Expressions of Quality in the following Testimonials. This Verdict is from Users of Copper Paint, that "New Jersey" Copper Paint leads them all.

New London, Conn.

Mr. Harry Louderbough.

Dear Sir.—A number of our barges and floating property have been painted with your "New Jersey" Copper Paint, and in our experience we have found it a very desirable and durable Paint. Its smoothness also, is a strong recommend for it, especially on large barges that are moved around our coast, as the resistance is greatly diminished by the Paint being finely ground making a smooth surface. Yours very truly,

THE THAMES TOW BOAT CO.

Port Hawkesbury, C. B.

Harry Louderbough, Esq.,
Jersey City, N. J., U. S. A.

Dear Sir.—We received the enclosed yesterday from Capt. Kelly, of the Steamer "John L. Cann," plying between Mulgrave and Canos, Nova Scotia.

Mulgrave, N. S.

Messrs. Peter Paint & Sons,
Port Hawkesbury, C. B.

Dear Sirs.—We painted our steamer "John L. Cann's" bottom with your "New Jersey" Copper Paint on August last, a little over four months ago. During that time our Steamer has kept clean and in better condition than ever before.

We have used a number of different kinds of copper paint and never before had the satisfaction we have had from our Copper Paint.

I think it is my duty to express the great satisfaction of having our Steamer clean under circumstances similar where other copper paints have failed. I may state that our speed on a run of nine mile had not reduced one minute since we applied the "New Jersey" Copper Paint. With other Paints our time has been lengthened eight minutes. Yours truly,

A. H. KELLY, (Capt. Stmr. Cann.)

It was quite unexpected on our part, for the fact is that is came unsolicited. Yours truly,

PETER PAINT & SONS.

Hoboken, N. J.

Mr. H. Louderbough.

Dear Sir.—The New Jersey Seam Paint purchased from you gives us splendid satisfaction, being of good weight and holding up well in the seams of vessels. We prefer it to all others.

Very truly.

TIETJEN & LANG.

Cambridge, Md.

Mr. H. Louderbough.

Dear Sir.—It is with great pleasure that I express to you my appreciation of the good qualities of your New Jersey Copper Paint that, in the few years it has been sold, has become such a favorite among our oystermen for its smoothness, giving a good sailing bottom, and as an Anti-Fouler resisted the encroachments of the barnacle, so very troublesome in the waters of our bay. I remain, yours truly,

RICHARDSON & DAVIS.

New York

H. Louderbough.

Dear Sir.—During the past two seasons we have used at our Dry Dock at Pier 52, E. R.., your New Jersey Copper Paint, and we are indeed greatly pleased with it. It is easy to apply, and makes a very smooth bottom.

JENKINS & TREGARTHEN.

THE REPUTATION OF OUR GOODS
IS OUR BIGGEST ASSET

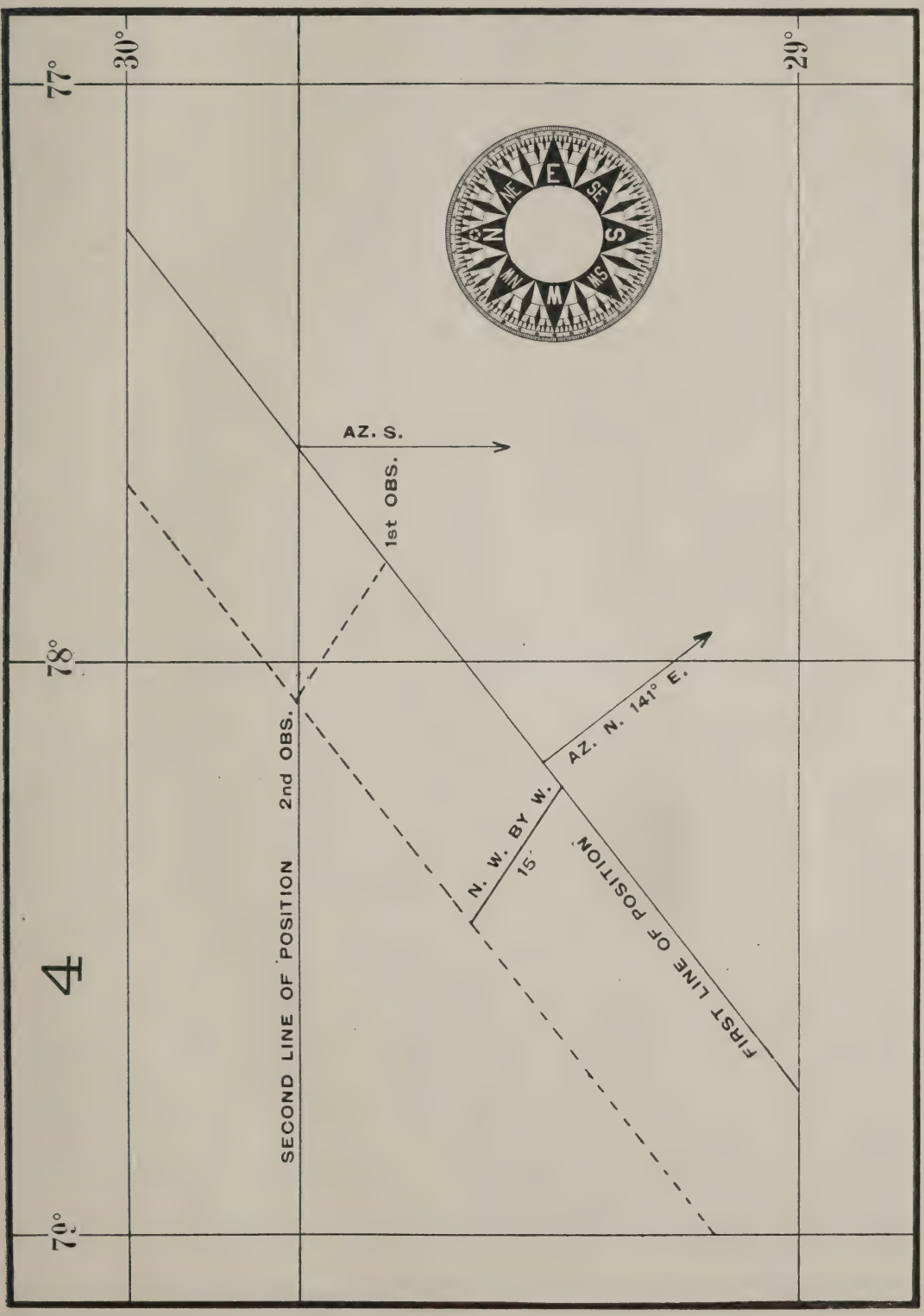

77°
30°
29°
78°
79°
AZ. S.
1st OBS.
2nd OBS.
SECOND LINE OF POSITION
AZ. N. 141° E.
N. W. BY W.
15'
FIRST LINE OF POSITION
4
E
NE
SE
S
SW
W
NW
N

PLATE No. 5.

Latitude by account 29° 30′ N. An observation of the sun worked with the latitude by account gave the longitude 78° 05′ W. The sun's true azimuth is N. 135° W., which may be taken from the azimuth tables corresponding to the apparent time found by observation. Place this bearing on the chart in the position fixed by observation and through the same point draw a line at right at angles to the azimuth and it will be the first line of position found by a single calculation. After the ship had sailed north (true) a distance of 20 miles the latitude 29° 45′ N. was found by meridian altitude of the moon which the second line of position east and west. Place the course and distance on the chart as shown, then move the first line of position to the end and rule a broken line, and at its intersection with the latitude by the moon or second line of position will be the position at the second observation. Move the course to the noon position and rule a broken line and its intersection with the first line of position will be the position at the time of the first observation.

TESTIMONIALS.

Mr. H. Louderbough,
c. o. N. J. Paint Works, Jersey City, N. J.

Dear Sir:—We enclose you a letter received to-day from a well-known yachtsman, Mr. George B. Waters. This letter was so interesting that we thought possibly you might like to see it and the writer has asked Mr. Waters whether he has any objections to you using this letter if you so desire. He says he has not and will back up everything that he says in the letter. If you care to use it you are at liberty to do so. He certainly is very enthusiastic about the small expense he has been under using this paint.

Yours very truly,
C. D. DURKEE & CO.

C. D. Durkee & Co., 2 South St., New York.

Gentlemen:—Send me at once another gallon of New Jersey Brown Copper Paint for my launch. My house boat "Reverie" had one coat of this paint this season and has been lying still at a mooring at Port Washington, L. I., all summer and when I hauled her out to examine her bottom, I found it to be as smooth as the day she was launched and entirely free from any marine growth or barnacles. The boats all around me (most of them yachts and working boats which were in constant use and which naturally would not foul as readily as my boat lying still) have been hauled out several times and each time were absolutely covered with barnacles and the awful condition they were in induced me to put my boat ashore for examination. Much to my gratification and surprise and particularly to the men who hauled her out, she was clean as a bottle, despite the fact that she has had but one coat of your paint this year. My launch and my two small boats which were painted with another make of copper, were so covered with growth that I had actually to chop it off. My mooring chains were so covered with the barnacles that they looked like huge cables, but the bottom of my boat was like an inside floor. This season has been one of the very worst for marine growth that we have experienced for many years and New Jersey paint has stood the test so marvelously and in such great contrast to some other well known makes of paint, that my conscience would plague me if I neglected the opportunity to sing its praises and to thank you for recommending such an efficient preventure for fouling. I would like to add that my boat was moored for last season in the Shrewsbury River, N. J., and had but one coat of New Jersey paint during the entire year and my experience was exactly the same. I write you this simply because I feel it my duty to praise a good article as strongly as I would condemn it if it were not.

Yours sincerely,
GEORGE B. WATERS.

New York City, N. Y.,

Harry Louderbough. Esq., Jersey City, N. J.

Dear Sir:—Many thanks for a copy of the Second Edition of the Navigator or Mariner's Guide, the receipt of which reminds me of an incident in connection with the first edition which may interest you. In 1906 I was requested to become the guardian of a young Japanese boy, Kazatura Ariyoski, so that he might be eligible to enter the Schoolship St. Mary's. At that time he was one of the crew of the U. S. Revenue Steamer "Rush," stationed on the Pacific coast and among other things I sent to him was a copy of the 1st edition of the "Navigator" or "Mariner's Guide." With this compendium of navigation in hand he at once began its careful study and was making splendid progress looking forward to the time he would join the Schoolship at New York, that he might have at least a rudimentary knowledge of navigation. Unfortunately his seafaring career was cut short by the development of tuberculosis and he was transferred to the U. S. Marine Hospital at Fort Stanton, New Mexico, where he still remains at this writing.

Yours truly,
B. S. OSBON.

New York City, N. Y.,

Harry Louderbough, Esq., Jersey City, N. J.

Dear Sir:—Allow me to congratulate you on the remarkably interesting and instructive Mariner's Guide published by your company. It is the best all-around publication I have yet run across for the use of men taking up the study of practical navigation, pilotage and general work affiliated with the Naval Militia.

Very truly yours,
ECKFORD C. DE KAY,
Lieut. Com., N. M. N. Y.

Washington, D. C.,

New Jersey Paint Works, Jersey City, N. J.

Gentlemen :—I have used your New Jersey Yacht Green Copper Paint for years. It is the best bottom paint in my opinion. I have tried all prominent brands.

Yours truly,
CHARLES H. COE.

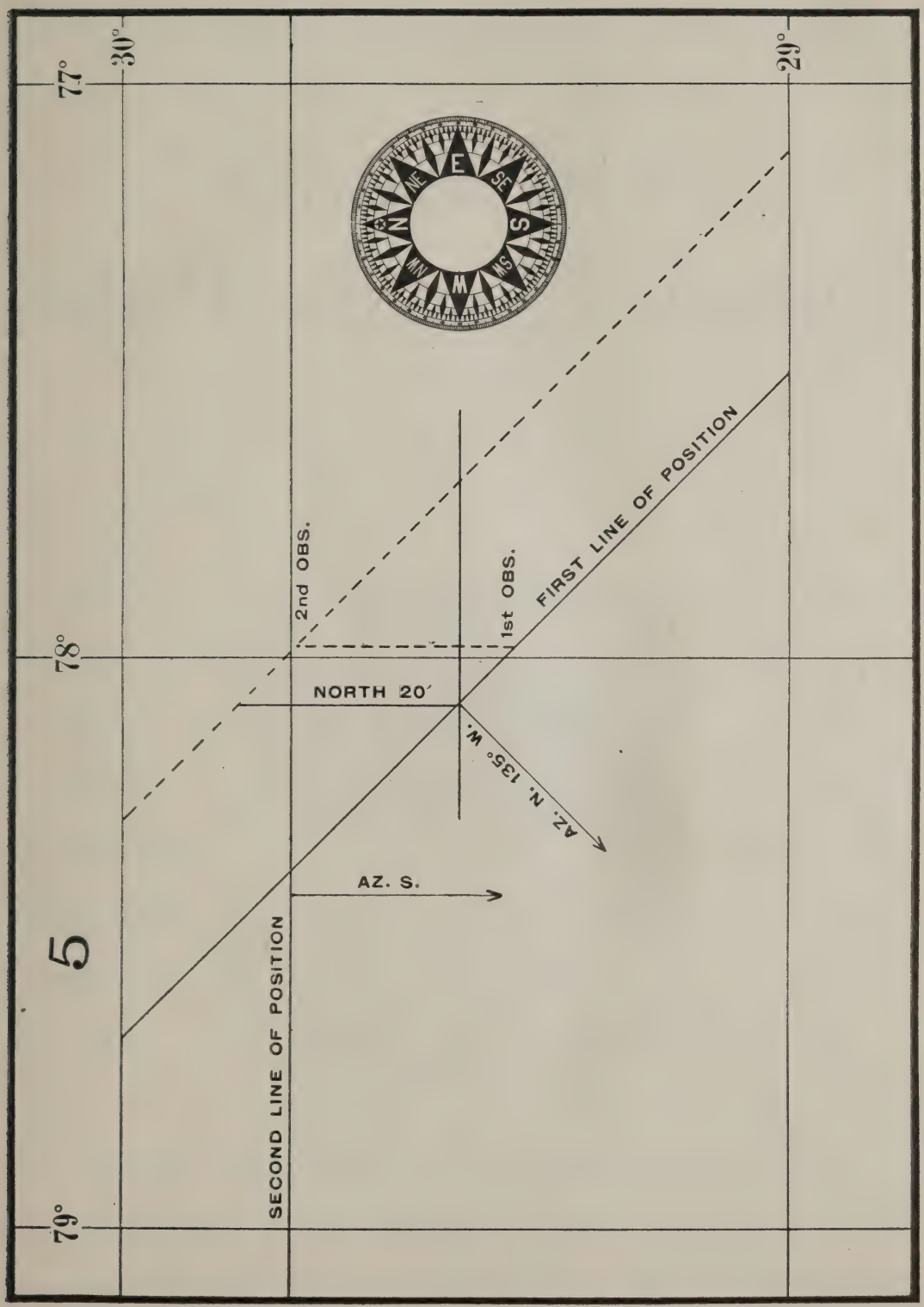

77°
30°
29°
78°
79°
5
2nd OBS.
1st OBS.
FIRST LINE OF POSITION
NORTH 20′
AZ. N. 135° W.
AZ. S.
SECOND LINE OF POSITION
E
SE
S
SW
W
NW
N
NE

PLATE No. 6.

This illustration does not require an explanation, it being two observations at the same time, one of the sun and the other of the moon, from which two lines of position are found at once, the ship's position being at the point of crossing.

"NEW JERSEY"

Elastic Seam Paint

Popular, because it is effective,
And does away with the pitch pot

Try It and be Convinced of Its Merit

HIGHEST AWARDED MEDAL
BY AMERICAN INSTITUTE OF NEW YORK CITY.
NEW JERSEY
Elastic Seam Paint
THE MOST USED. WHY? BECAUSE IT IS THE BEST.
MANUFACTURED BY
NEW JERSEY PAINT WORKS
H. LOUDERBOUGH, Proprietor.
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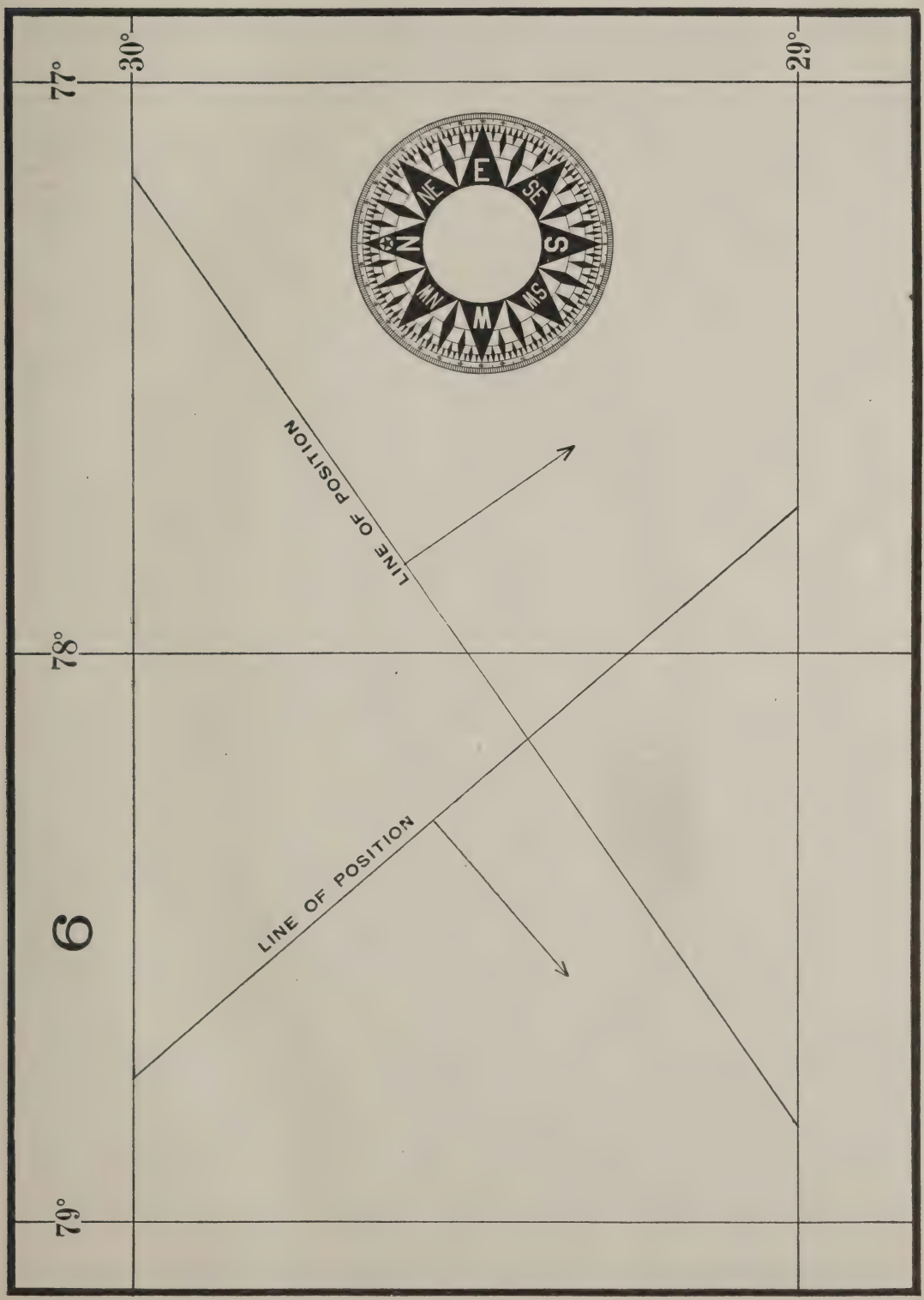
Cable Address "JERSEY."

A Seam Brush Applies It over the Oakum

The advantage that it has over other Fillers is, that Copper Paint will adhere to it. Working of the Vessel does not crack it . . . . . .


77°
30°
29°
78°
79°
E
NE
SE
S
N
NW
SW
W
LINE OF POSITION
LINE OF POSITION
9

The Sextant and Octant.

The sextant or some similar instrument is used by navigators to measure angular distances between either celestial or terrestial objects, and without it accurate observations for the determination of a ship's position would not be possible.

The arc of the sextant is divided to degrees, each of which is subdivided to ten minutes (′), and by the use of the vernier, angles are read to ten seconds (″).

To read off an altitude, note the first division on the arc to the right of the zero on the vernier, and then follow along the vernier to the left and the first division which coincides exactly with one on the arc will give the odd minutes and seconds of the reading. Figure one represents the vernier and part of the arc of a sextant cut to ten seconds. Each degree is divided to ten minutes. The zero on the vernier is between 20° 10′ and 20° 20′. Look along the vernier and the fifth line past three will be found to cut a line exactly on the arc. As each minute on the vernier is divided to ten seconds, the reading is 3′ 50″, which, when added to that on the arc, will give 20° 13′ 50″. If the zero on the vernier exactly cuts a line on the arc, there will be no odd minutes or seconds shown on the vernier.

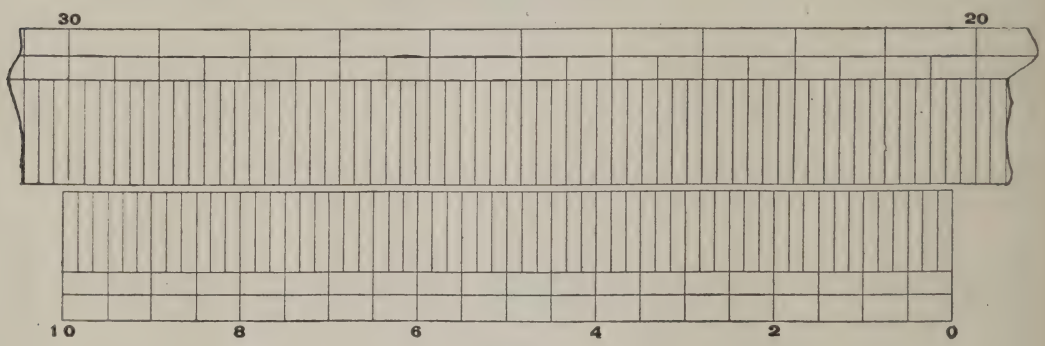


Fig. 1.

All altitudes or other angular distances measured with the sextant are read in this manner.

When the zero on the vernier is to the left of that on the arc, the angle is said to be "on the arc," but to the right "off the arc." This applies to the index error which is the quantity a sextant may indicate more or less than the truth, and is the result of the index and horizon mirrors being parallel to each other when the zero on the vernier and that on the arc do not cut exactly. In other words, if the zero on the vernier and that on the arc coincide exactly, there will be index error if the horizon and index mirrors are not exactly parallel to each other. It is preferable to have the sextant correct as it only means additional labor to apply the error, and there always exists a possible chance of neglecting its use, in which case the result of the observation will not be correct. In fact, the instrument is supposed to be properly adjusted if possible and only use a correction when the adjustment cannot be made; but at sea or in ports where good repairs cannot be made, it is a wise plan to not disturb the adjusting screws unless absolutely necessary, as they are brass and are easily broken or injured.

When the zero on the vernier is to the left of that on the arc, the index error is read the same as any other angle and is to be subtracted from all altitudes observed. If the zero on the vernier is to the right of that on the arc, as shown in Figure two, it is read from the left towards the right. In this case the reading is less than ten minutes "off the arc." Reading from the left to right, the fifth division to the right of three minutes cuts a division on the arc exactly. This reading, called the index correction, is 3′ 50″ and is to be added to all altitudes or

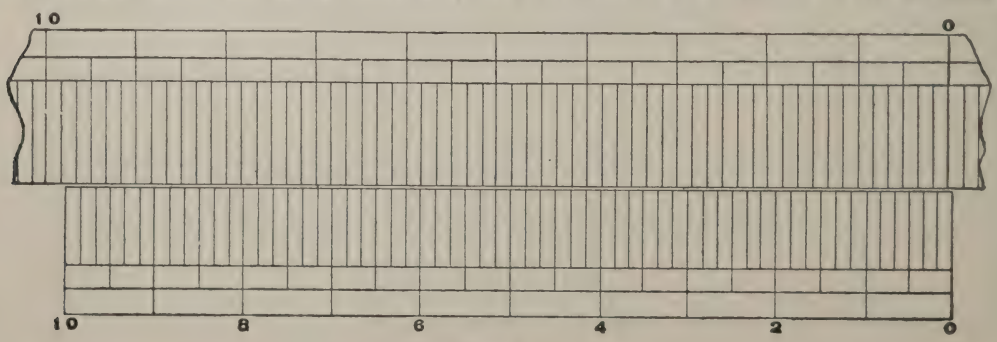


Fig. 2.

other angles measured. The divisions to the right of the zero on the arc are called the extra arc or arc of excess.

The index error may be found by moving the index bar until the horizon shows an unbroken line through the horizon glass.

A more accurate method is to measure the diameter of the sun on the arc and off. Half the difference between them will be the index correction. If the greater reading is off the arc, it is added to, and if the greater reading is on the arc, it is subtracted from the altitudes measured. To prove the correctness of the error thus found, add together the two diameters of the sun measured and divide them by four, and the result should be the same as the sun's semi-diameter in the Nautical Almanac for that day.

Example: May 16, 1902. The sun's diameter measured as follows: On the arc 33′ 10″. Off the arc 30′ 10″. Find the index error and prove it.

Reading on the arc	33′	10″		33′	10″
Reading off the arc	30	10		30	10
	2) 3	00		4) 3	20
Index error subtractive	1	30	Semi-diam N. A.	= 15	50

The index error found is 1′ 30″ subtractive because the greater reading is on the arc, and its correctness is proven because the sum of the two readings divided by four corresponds with the sun's semi-diameter given in the Nautical Almanac for May 16, 1902—the date of the observation.

The principle of reading the sextant applies to the other reflecting instruments used by navigators, which are divided differently. The octant has four divisions to each degree on the arc and to each minute on the vernier. Then each division on the arc represents 15′ and on the vernier 15″, as in Figure three, which shows part of the arc of an octant and the vernier.

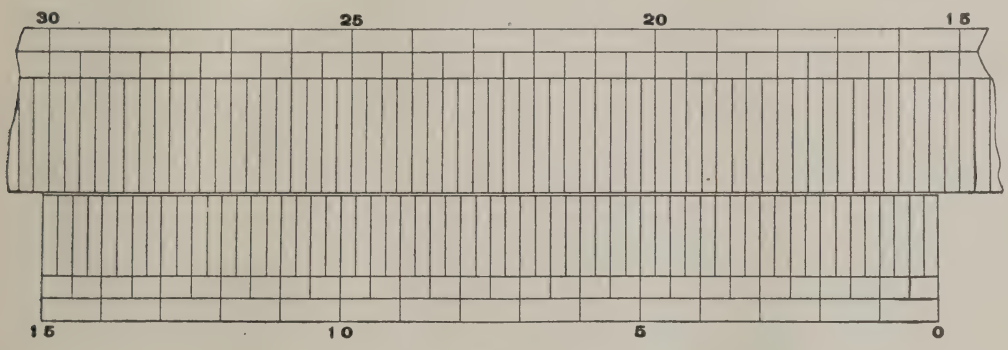


Fig. 3.

To read off an altitude, note the first division on the arc to the right of the zero on the vernier, and then follow along the vernier to the left and the first division which coincides exactly with one on the arc will give the odd minutes and seconds of the reading. The zero of the vernier in Figure three is between 15° 15′ and 15° 30′. Look along the vernier and the first line to the left of five, which is 5′ 15″, exactly cuts a division on the arc. This added to the 15° 15′ on the arc makes the reading 15° 20′ 15″. These two instruments are the ones most generally used by navigators and are to be preferred to the less expensive ones which, strange as it may seem, are somewhat extensively used in the smaller vessels.

Figure four shows one of these, the degrees on the arc of which is divided into three divisions of twenty minutes each, with a vernier cut to half minutes or thirty seconds.

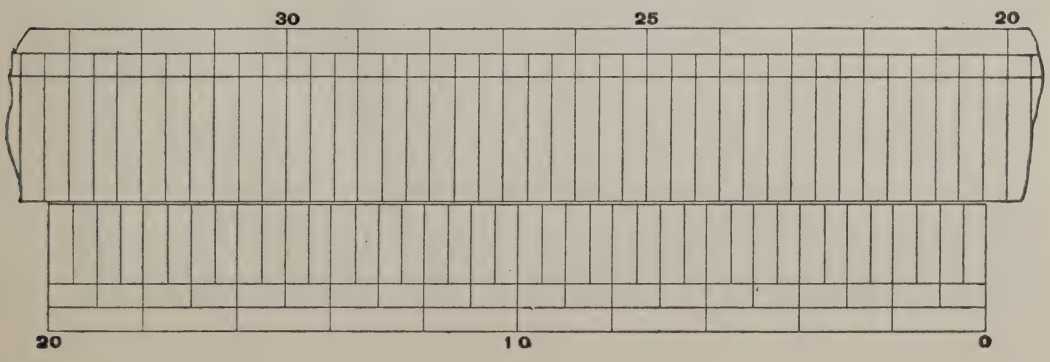


Fig. 4.

Following the same rule used in reading the sextant and octant, Figure four will be found to read 20° 15′ 30″. The objection to this instrument and others cut to less than fifteen seconds, is that the altitudes measured are not sufficiently exact. Even with a fine sextant, the error of the observed altitude is sometimes as great as thirty seconds when no telescope is used.

Another of these instruments is shown in Figure five. The arc in this case is divided to twenty minutes and the vernier to minutes. By this instrument, only minutes can be read from the vernier.

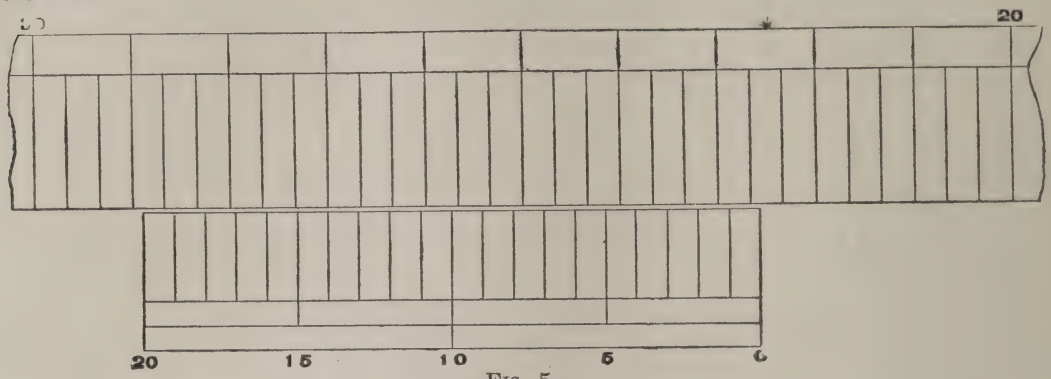


FIG. 5.

The zero on the vernier is between 22° 20′ and 22° 40′ on the arc. Look along the vernier for the odd minutes, which are fourteen. This added to the reading on the arc gives 22° 34′ 00″

ADJUSTMENTS OF THE SEXTANT.

FIRST. Move the vernier to about the middle of the arc and holding the instrument with the index mirror towards the eye, and if the true and reflected arcs show in an unbroken line in the index mirror, it is perpendicular to the plane of the instrument. If the arcs show in a broken line, the glass is not perpendicular and requires adjustment, which is effected by use of the outer screw back of the glass.

SECOND. Make the zero on the vernier coincide exactly with that on the arc, and to be exact, the last division on the vernier must also coincide exactly with one on the arc, then clamp the instrument firmly and hold it face up, looking through the sight tube, see if the true and reflected horizons show in an unbroken line through the horizon mirror. If they do, the glass is perpendicular to the plane of the instrument. If in a broken line, the glass is not perpendicular and requires adjustment, which is effected by use of the key under the horizon glass. Some instruments have a fixed horizon, in which case the adjustment is made by moving the glass only with the screws.

THIRD. Keeping the zero on the vernier clamped at zero on the arc, hold the instrument vertically or in the position for observing altitudes, and if the horizon and index mirrors are parallel to each other, the horizon will appear in an unbroken line through the horizon glass. If it appears in a broken line, adjustment is necessary. This is effected by the screws, using the pin to turn them. If the horizon is a fixed one, the adjustment is made by moving the glass only with the screw.

FOURTH. The axis of the telescope must be parallel to the plane of the instrument. Screw in the telescope so that one pair of wires will be parallel to the plane of the instrument. Measure the angular distance between two stars not nearer than ninety degrees from each other, making the contact on the wire nearest the plane of the instrument and clamp it. By a slight change in the position of the instrument, make the contact on the other wire, and if it is perfect, the axis of the telescope is parallel to the plane of the instrument. If the contact is imperfect, the adjustment is made by slacking or setting up the screws in the collar in which the telescope is screwed: but before setting up one of these screws, the other must be slacked, and when the adjustment is complete both screws must be tight.

The adjustment for the quadrant are the same as those for the sextant, except that of the telescope, this instrument having none.

In case the adjustments cannot be made, find the index error and apply it to any angle measured.

LOOK FOR THIS LABEL AND BE PROTECTED

NON
EXPLOSIVE
NEW JERSEY
BRIGHTEST
NO ACID
NO ALKALI
POPULAR
SAFE
NO BENZINE
NO WATER
BEST
LIQUID METAL POLISH
A LIGHTNING CLEANSER. PRODUCING A POLISH OF ELEGANT AND LASTING AND DURABLE FINISH ON ALL METAL WORK. SUCH AS BRASS. NICKEL. TIN. COPPER. ZINC. BRASS. ZINC AND NICKEL SIGNS. RAILINGS. HARNESS TRIMMINGS. &C., WHETHER HOT OR COLD IN ALL CONDITIONS OF HEAT OR COLD. IT WILL NOT STAIN OR DEFACE WOOD WORK.
SHAKE THOROUGHLY BEFORE USING.
DIRECTIONS.
APPLY WITH WASTE, OR CLOTH, AND RUB BRISKLY UNTIL ALL TARNISH AND STAINS DISAPPEAR. THEN WIPE OFF WITH DRY CLOTH.
PUT UP IN QUARTER PINT. HALF PINT. PINT. QUART. HALF GALLON AND GALLON.
NEW JERSEY PAINT WORKS
JERSEY CITY, N.J. U.S.A.
HARRY LOUDERBOUGH. PROPRIETOR.

LENGTH OF A DEGREE OF LONGITUDE IN EACH DEGREE OF LATITUDE.

Lat.	Length Deg. Long.	Lat.	Length Deg. Long.	Lat.	Length Deg. Long.
°		°	′	°	′
1	60 0	31	51 4	61	29 1
2	60 0	32	50 9	62	28 2
3	59 9	33	50 3	63	27 2
4	59.9	34	49 7	64	26.3
5	59 8	35	49 1	65	25 4
6	59 7	36	48 5	66	24 4
7	59 6	37	47 9	67	23 4
8	59 4	38	47 3	68	22.5
9	59 3	39	46 6	69	21.5
10	59 1	40	46 0	70	20.5
11	58 9	41	45 3	71	19.5
12	58 7	42	44 6	72	18 5
13	58 5	43	43 9	73	17 5
14	58.2	44	43 2	74	16 5
15	58 0	45	42.4	75	15 5
16	57 7	46	41 7	76	14 5
17	57 4	47	40 9	77	13 5
18	57 1	48	40 1	78	12 5
19	56 7	49	39 4	79	11 4
20	56.4	50	38 6	80	10.4
21	56 0	51	37 8	81	9 4
22	55 6	52	36 9	82	8 4
23	55.2	53	36 1	83	7 3
24	54.8	54	35 3	84	6 3
25	54 4	55	34 4	85	5 2
26	53.9	56	33 6	86	4.2
27	53 5	57	32 7	87	3.1
28	53 0	58	31 8	88	2 1
29	52 5	59	30 9	89	1.0
30	52 0	60	30 0	90	.0

TABLE FOR FINDING DISTANCE OFF BY TWO BEARINGS AND THE DISTANCE RUN.

DIFFERENCE BETWEEN COURSE AND SECOND BEARING-POINTS.	Points.	DIFFERENCE BETWEEN COURSE AND FIRST BEARING-POINTS.															
		2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
	4	1.00																
	4½	0.81	1.23															
	5	0 69	1 00	1.45														
	5½	0 60	0 85	1 17	1.66													
	6	0 54	0 74	1.00	1 35	1.85												
	6½	0.49	0 67	0 88	1.14	1.50	2 02											
	7	0 46	0.61	0 79	1 00	1 27	1 64	2 17										
	7½	0.43	0 57	0 72	0.90	1 11	1.39	1 77	2 30									
	8	0 41	0.53	0 67	0 82	1 00	1 22	1.50	1.87	2.41								
	8½	0.40	0 51	0 63	0.76	0.92	1.09	1 31	1.58	1 96	2 50							
	9	0 39	0 49	0 60	0 72	0 85	1.00	1.18	1 39	1 66	2 03	2 56						
	9½	0 38	0.48	0 58	0 69	0 80	0 93	1 08	1 25	1 46	1 72	2.08	2 60					
	10	0 38	0 47	0.57	0 66	0 76	0.88	1 00	1 14	1 31	1 51	1 76	2 11	2 61				
	10½	0 38	0 47	0.56	0 65	0 74	0 84	0 94	1.06	1 19	1 35	1 55	1 79	2 12	2 60			
	11	0 39	0 47	0.56	0 64	0 72	0 81	0 90	1 00	1 11	1 24	1 39	1 57	1 80	2 11	2 56		
	11½	0 40	0 48	0.56	0 64	0.71	0 79	0 87	0 95	1.05	1.15	1 27	1 41	1 58	1.79	2 08	2.50	
	12	0.41	0.49	0.57	0.64	0.71	0 78	0 85	0 92	1.00	1 08	1 18	1.29	1 41	1.57	1 76	2 08	2.41

Example: Ship steering N. by E. had Barnegat light bearing N. N. W., and then run 12 miles, when the light bore W. by N.

Diff. between course and 1st bearing	3 points.
" " " " 2d "	8 "
Number corresponding	0.67
Distance	× 12
Dist. off Barnegat at 2d bearing	8.04 miles.

Use "New Jersey" Seam Paint and do away with your pitch pot before you have a fire.

This table contains the correction to be added to the observed altitude of the sun's lower limb to obtain the true altitude of the sun's center. It embraces the four corrections—semi-diameter (16′ 00″), dip, mean refraction and parallax.

Obs alt. Sun's L. L.	HEIGHT OF THE EYE IN FEET.																
	5	7	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50
° ′	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
7 00	6 34	6 09	5 39	5 21	5 05	4 50	4 36	4 22	4 09	3 57	3 45	3 34	3 23	2 57	2 33	2 09	1 49
7 30	7 01	6 36	6 06	5 48	5 32	5 17	5 03	4 49	4 36	4 24	4 12	4 01	3 50	3 24	3 00	2 36	2 16
8 00	7 25	7 00	6 30	6 12	5 56	5 41	5 27	5 13	5 00	4 48	4 36	4 25	4 14	3 48	3 24	3 00	2 40
8 30	7 46	7 25	6 51	6 33	6 17	6 02	5 48	5 34	5 21	5 09	4 57	4 46	4 35	4 09	3 45	3 21	3 01
9 00	8 05	7 40	7 10	6 52	6 36	6 21	6 07	5 53	5 40	5 28	5 16	5 05	4 54	4 28	4 04	3 40	3 20
10 00	8 39	8 14	7 44	7 26	7 10	6 55	6 41	6 27	6 14	6 02	5 50	5 39	5 28	5 02	4 38	4 14	3 54
11 00	9 07	8 42	8 12	7 54	7 38	7 23	7 09	6 55	6 42	6 30	6 18	6 07	5 56	5 30	5 06	4 42	4 22
12 00	9 31	9 03	8 36	8 18	8 02	7 47	7 33	7 19	7 06	6 54	6 42	6 31	6 20	5 54	5 30	5 06	4 46
13 00	9 51	9 26	8 56	8 38	8 22	8 07	7 53	7 39	7 26	7 14	7 02	6 51	6 40	6 14	5 50	5 26	5 06
14 00	10 09	9 44	9 14	8 56	8 40	8 25	8 11	7 57	7 44	7 32	7 20	7 09	6 58	6 32	6 08	5 44	5 24
15 00	10 24	9 50	9 29	9 11	8 55	8 40	8 26	8 12	7 59	7 47	7 35	7 24	7 13	6 47	6 23	5 59	5 39
17 30	10 54	10 29	9 59	9 41	9 25	9 10	8 56	8 42	8 29	8 17	8 05	7 54	7 43	7 17	6 53	6 29	6 09
20 00	11 18	10 53	10 23	10 05	9 49	9 34	9 20	9 06	8 53	8 41	8 29	8 18	8 07	7 41	7 17	6 53	6 33
22 30	11 37	11 12	10 42	10 24	10 08	9 53	9 39	9 25	9 12	9 00	8 48	8 37	8 26	8 00	7 36	7 12	6 52
25 00	11 53	11 28	10 58	10 40	10 24	10 09	9 55	9 41	9 28	9 16	9 04	8 53	8 42	8 16	7 52	7 28	7 08
27 30	12 06	11 41	11 11	10 53	10 37	10 22	10 08	9 54	9 41	9 29	9 17	9 06	8 55	8 29	8 05	7 41	7 21
30 00	12 16	11 51	11 21	11 03	10 47	10 32	10 18	10 03	9 51	9 39	9 27	9 16	9 05	8 39	8 15	7 51	7 31
35 00	12 33	12 08	11 38	11 20	11 04	10 49	10 35	10 21	10 08	9 56	9 44	9 33	9 22	8 56	8 32	8 08	7 48
40 00	12 47	12 22	11 52	11 34	11 18	11 03	10 49	10 35	10 22	10 10	9 58	9 47	9 36	9 10	8 46	8 22	8 02
50 00	13 06	12 41	12 11	11 53	11 37	11 22	11 08	10 54	10 41	10 29	10 17	10 06	9 55	9 29	9 05	8 41	8 21
60 00	13 19	12 54	12 24	12 06	11 50	11 35	11 21	11 07	10 54	10 42	10 30	10 19	10 08	9 42	9 18	8 54	8 34
75 00	13 35	13 10	12 40	12 22	12 06	11 51	11 37	11 23	11 10	10 58	10 46	10 35	10 24	9 58	9 34	9 10	8 50
90 00	13 49	13 24	12 54	12 36	12 20	12 05	11 51	11 37	11 24	11 12	11 00	10 49	10 38	10 12	9 48	9 24	9 04

This table contains the correction for the month to be applied to the correction from the above table according to sign.

Day of the month.	MONTH.											
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	+ 17″	+ 15″	+ 9″	+ 1″	− 7″	− 13″	− 15″	− 13″	− 8″	0″	+ 8″	+ 15″
10	+ 17	+ 13	+ 7	− 1	− 9	− 14	− 15	− 12	− 6	+ 2	+ 10	+ 16
20	+ 16	+ 11	+ 4	− 4	− 11	− 15	− 14	− 10	− 3	+ 5	+ 13	+ 17

This table contains the negative altitude corresponding to the height of the eye for finding the longitude by sun-rise and sun-set observations.

Sun's Limb.	HEIGHT OF THE EYE IN FEET.																
	5	7	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50
L. L.	22′31″	22′56″	23′26″	23′44″	24′00″	24′15″	24′29″	24′43″	24′56″	25′08″	25′20″	25′31″	25′42″	26′08″	26′32″	26′56″	27′16′
U. L.	54 49	55 14	55 44	56 02	56 18	56 33	56 47	57 01	57 14	57 26	57 38	57 49	58 30	58 26	58 50	59 14	59 34

This table contains the correction for the month to be applied to the negative altitude as taken from the above table. When the upper limb is observed, apply the correction according to the sign; but if the lower limb is observed, apply it contrary to the sign.

Day of the Month.	MONTH.											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	+ 17″	+ 15″	+ 9″	+ 1″	− 7″	− 13″	− 15″	− 13″	− 8″	0″	+ 8″	+ 15″
10	+ 17	+ 13	+ 7	− 1	− 9	− 14	− 15	− 12	− 6	+ 2	+ 10	+ 16
20	+ 16	+ 11	+ 4	− 4	− 11	− 15	− 14	− 10	− 3	+ 5	+ 13	+ 17

Good Products are Well Advertised—So is "New Jersey" Copper Paint.

ELEMENTS FROM THE NAUTICAL ALMANAC FOR THE YEAR 1902, TO BE USED IN WORKING THE SEVERAL PROBLEMS IN THIS WORK.

AT GREENWICH APPARENT NOON. I

Day of the Week.	Day of the Month.	THE SUN'S Apparent Right Ascension.	Diff. for 1 Hour.	Apparent Declination	Diff. for 1 Hour.	Semi-diameter.	Sidereal Time of Semi-diameter Passing Meridian.	Equation of Time, to be Added to / Subtracted from / Added to / Subtracted from Apparent Time.	Diff. for 1 Hour.
		h m s	s	° ′ ″	″	′ ″	s	m s	s
JANUARY.									
Wed.	1	18 44 14.20	11.051	S. 23 03 38.1	11.68	16 17.13	71.02	3 25.09	1.192
Tues.	7	19 10 39.19	10.955	22 27 23.5	18.48	16 17.05	70.69	6 10.31	1.096
Thurs.	16	19 49 42.94	10.731	S. 21 03 26.3	28.01	16 16.63	69.97	9 44.46	0.872
Fri.	24	20 23 39.44	10.478	S. 19 21 26.1	35.59	16 15.90	69.15	12 08.11	0.620
FEBRUARY.									
Sat.	8	21 25 01.58	9.977	S. 15 11 17.0	47.15	16 13.79	67.46	14 21.56	0.120
Thurs.	27	22 38 35.83	9.420	S. 8 34 43.0	56.19	16 09.87	65.56	13 01.52	0.435
MARCH.									
Fri.	7	23 08 28.62	9.263	S. 5 31 23.3	58.20	16 07.90	64.99	11 22.16	0.591
Sat.	8	23 12 10.74	9.247	5 08 04.1	58.38	16 07.65	64.93	11 07.77	0.607
Mon.	10	23 19 33.86	9.217	4 21 13.8	58.69	16 07.13	64.83	10 37.87	0.638
Mon.	17	23 45 14.54	9.131	1 35 56.5	59.24	16 05.29	64.54	8 43.00	0.723
Fri.	21	23 59 49.56	9.101	0 01 08.6	59.22	16 04.20	64.44	7 31.99	0.754
Sat.	22	0 03 27.91	9.096	N. 0 22 32.2	59.18	16 03.93	64.42	7 13.84	0.759
Thurs.	27	0 21 38.49	9.085	N. 2 20 31.6	58.76	16 02.56	64.38	5 41.92	0.769
APRIL.									
Thurs.	17	1 38 28.19	9.256	N. 10 14 31.9	53.02	15 56.81	64.98	0 15.01	0.599
Sat.	18	1 42 10.52	9.271	10 35 39.3	52.59	15 56.55	65.04	0 29.20	0.584
Tues.	29	2 23 24.34	9.482	N. 14 15 17.6	46.98	15 53.76	65.77	2 37.10	0.373
MAY.									
Sun.	4	2 42 29.10	9.598	N. 15 46 13.1	43.90	15 52.58	66.17	3 15.02	0.258
Fri.	16	3 29 14.16	9.879	N. 18 56 41.1	35.16	15 50.00	67.14	3 48.52	0.023
Mon.	19	3 41 07.94	9.948	N. 19 37 25.0	32.71	15 49.43	67.39	3 44.42	0.092
JUNE.									
Wed.	11	5 14 47.27	10.356	N. 23 02 33.3	11.18	15 46.12	68.75	0 46.36	0.498
Mon.	16	5 35 32.09	10.387	N. 23 19 49.8	6.08	15 45.68	68.86	0 15.50	0.528
JULY.									
Mon.	14	7 32 12.94	10.149	N. 21 47 41.1	22.05	15 45.21	68.06	5 31.89	0.292
AUGUST.									
Fri.	8	9 09 49.29	9.554	N. 16 20 47.1	42.16	15 47.68	66.01	5 34.35	0.301
Sat.	9	9 13 38.29	9.529	N. 16 03 47.3	42.81	15 47.83	65.92	5 26.82	0.326
Thurs.	14	9 32 34.38	9.408	N. 14 35 03.1	45.87	15 48.65	65.52	4 40.28	0.448
SEPTEMBER.									
Thurs.	18	11 40 15.22	8.966	N. 2 08 16.2	58.05	15 56.45	63.97	5 36.55	0.887
Tues.	23	11 58 11.77	8.981	N. 0 11 43.9	58.44	15 57.77	64.01	7 22.46	0.873
OCTOBER.									
Mon.	20	13 36 59.33	9.409	S. 10 06 02.7	54.11	16 05.18	65.52	15 00.54	0.445
NOVEMBER.									
Fri.	21	15 43 56.99	10.468	S. 19 46 35.1	33.73	16 12.80	69.12	14 12.76	0.610
Thurs.	27	16 09 18.88	10.666	S. 21 00 51.9	28.07	16 13.90	69.76	12 30.49	0.807
DECEMBER.									
Wed.	3	16 35 07.43	10.835	S. 22 00 57.9	21.92	16 14.85	70.31	10 21.64	0.976
Sat.	6	16 48 10.20	10.906	22 25 21.1	18.69	16 15.26	70.55	9 08.74	1.046
Sat.	20	17 49 53.49	11.099	S. 23 25 45.1	2.67	16 16.67	71.18	2 38.31	1.239

II AT GREENWICH MEAN NOON.

Day of the Week	Day of the Month.	THE SUN'S Apparent Right Ascension.			Diff. for 1 Hour.	Apparent Declination.			Diff. for 1 Hour.	Equation of Time, to be Subtracted from / Added to		Diff. for 1 Hour.	Sidereal Time, or Right Ascension of Mean Sun. Diff. for 1 Hour. + 9s.8565		
		h	m	s	s	°	′	″	″	m	s	s	h	m	s
JANUARY.															
Wed.	1	18	44	13.57	11.047	S. 23	03	28.8	11.68	3	25.05	1.192	18	40	48.53
Tues.	7	19	10	38.07	10.952	22	27	25.4	18.46	6	10.20	1.096	19	04	27.87
Thurs.	16	19	49	41.20	10.728	S. 21	03	30.8	27.99	9	44.32	0.872	19	38	56.88
Fri.	24	20	23	37.32	10.477	S. 19	21	33.3	35.58	12	07.99	0.620	20	11	29.33
FEBRUARY.															
Sat.	8	21	24	59.19	9.977	S. 15	11	28.3	47.14	14	21.53	0.120	21	10	37.66
Thurs.	27	22	38	33.79	9.421	S. 8	34	55.2	56.19	13	01.61	0.435	22	25	32.18
MARCH.															
Fri.	7	23	08	26.87	9.265	S. 5	31	34.3	58.21	11	22.27	0.591	22	57	04.60
Sat.	8	23	12	09.03	9.249	5	08	14.9	58.39	11	07.88	0.607	23	01	01.15
Mon.	10	23	19	32.23	9.218	4	21	24.2	58.70	10	37.98	0.638	23	08	54.25
Mon.	17	23	45	13.22	9.133	1	36	05.1	59.25	8	43.12	0.723	23	36	30.12
Fri.	21	23	59	48.41	9.103	S. 0	01	16.1	59.23	7	32.09	0.754	23	52	16.32
Sat.	22	6	03	26.81	9.098	N. 0	22	25.0	59.19	7	13.93	0.759	23	56	12.88
Thurs.	27	0	21	37.63	9.987	N. 0	20	26.0	58.77	5	41.99	0.769	0	15	55.64
APRIL.															
Thurs.	17	1	38	28.33	9.258	N. 10	14	32.1	53.03	0	15.01	0.599	1	38	43.24
Sat.	18	1	42	10.59	9.273	10	35	39.7	52.60	0	29.20	0.584	1	42	39.79
Tues.	29	2	23	24.76	9.483	N. 14	15	19.6	46.98	2	37.12	0.373	2	26	01.88
MAY.															
Sun.	4	2	42	29.62	9.599	N. 15	46	15.5	43.90	3	15.03	0.258	2	45	44.65
Fri.	16	3	29	14.78	9.879	N. 18	56	43.3	35.16	3	48.52	0.023	3	33	03.30
Mon.	19	3	41	08.56	9.948	N. 19	37	27.0	32.71	3	44.41	0.092	3	44	52.97
JUNE.															
Wed.	11	5	14	47.41	10.355	N. 23	02	33.5	11.18	0	46.35	0.498	5	15	33.76
Mon.	16	5	35	32.05	10.386	N. 23	19	49.8	6.08	0	15.50	0.528	5	35	16.55
JULY.															
Mon.	14	7	31	12.00	10.148	N. 21	47	43.1	22.05	5	31.86	0.292	7	25	40.14
AUGUST.															
Fri.	8	9	09	48.40	9.555	N. 16	20	50.9	42.16	5	34.38	0.301	9	04	14.2
Sat.	9	9	13	37.42	9.530	N. 16	03	51.1	42.81	5	26.85	0.326	9	08	10.57
Thurs.	14	9	32	33.65	9.409	N. 14	35	06.7	45.87	4	40.31	0.448	9	27	53.34
SEPTEMBER.															
Thurs.	18	11	40	16.06	8.968	N. 2	08	10.7	58.06	5	36.63	0.887	11	45	52.69
Tues.	23	11	58	12.88	8.983	N. 0	11	36.7	58.45	7	22.57	0.873	12	05	35.45
OCTOBER.															
Mon.	20	13	37	01.71	9.411	S. 10	06	16.2	54.11	15	00.65	0.445	13	52	02.36
NOVEMBER.															
Fri.	21	15	43	59.47	10.466	S. 19	46	43.1	33.72	14	12.62	0.610	15	58	12.9
Thurs.	27	16	09	21.11	10.664	S. 21	00	57.8	28.06	12	30.32	0.807	16	21	51.43
DECEMBER.															
Wed.	3	16	35	09.30	10.832	S. 22	01	01.7	21.91	10	21.47	0.976	16	45	30.77
Sat.	6	16	48	11.86	10.903	22	25	23.9	18.68	9	08.58	1.046	16	57	20.44
Sat.	20	17	49	53.98	11.096	S. 23	25	45.2	2.67	2	38.26	1.239	17	52	32.24

GREENWICH MEAN TIME.

Day of the Month.	THE MOON'S SEMI-DIAMETER. Noon.	Midnight	HORIZONTAL PARALLAX. Noon.	Diff. for 1 Hour.	Midnight.	Diff. for 1 Hour.	UPPER TRANSIT. Meridian of Greenwich.	Diff. for 1 Hour.	AGE. Noon.
	′ ″	′ ″	′ ″	″	′ ″	″	h m	m	d
				AUGUST.					
14	14 48.1	14 49.4	54 13.6	0.30	54 18.3	0.47	8 35.8	1.99	10.7
15	14 51.2	14 53.5	54 25.0	0.63	54 33.4	0.77	9 23.7	1.99	11.7
				NOVEMBER.					
20	16 14.9	16 09.0	59 31.9	1.73	59 10.4	1.82	17 01.5	2.23	20.2
21	16 03.0	15 56.8	58 48.2	1.86	58 25.7	1.88	17 53.5	2.11	21.2

GREENWICH MEAN TIME.

THE MOON'S RIGHT ASCENSION AND DECLINATION.

Hour	Right Ascension	Diff. for 1 Minute	Declination	Diff. for 1 Minute
		AUGUST 14.		
21	18 31 05.30	2.0957	S. 18 30 44.1	2.533
		AUGUST 15.		
14	19 06 41.28	2.0917	S. 17 35 09.4	3.996
		NOVEMBER 20.		
12	8 46 54.40	2.3392	N. 12 44 23.4	8.532
		NOVEMBER 21.		
2	9 19 09.68	2.2694	N. 10 38 50.7	9.362

Mean Places for the Fixed Stars

FOR THE BEGINNING OF 1902.

Name of Star.	Magnitude.	Right Ascension.	Annual Variation.	Declination.	Annual Variation.
		h m s	s	° ′ ″	″
a Ursæ Min. (*Polaris*)	2	1 23 24.04	+25.628	+ 88 47 04.1	+ 18.74
a Arietis	2	2 01 38.80	+ 3.373	+ 22 59 57.1	+ 17.14
a Tauri (*Aldebaran*)	1	4 30 17.77	+ 3.439	+ 16 18 45.0	+ 7.46
β Orionis (*Rigel*)	1	5 09 49.66	+ 2.882	− 8 18 52.7	+ 4.35
*a*² Geminorum (*Castor*)	2	7 28 20.89	+ 3.835	+ 32 06 13.9	− 7.62
a Canis Minoris (*Procyon*)	1	7 34 10.34	+ 3.143	+ 5 28 34.5	− 9.04

Duty to Stand-By after Collision.

AN ACT IN REGARD TO COLLISIONS AT SEA.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in every case of collision between two vessels it shall be the duty of the master or person in charge of each vessel, if and so far as he can do so without serious danger to his own vessel, crew, and passengers (if any), to stay by the other vessel until he has ascertained that she has no need of further assistance, and to render to the other vessel, her master, crew, and passengers (if any), such assistance as may be practicable and as may be necessary in order to save them from any danger caused by the collision, and also to give to the master or person in charge of the other vessel the name of his own vessel and her port of registry, or the port or place to which she belongs, and also the names of the ports and places from which and to which she is bound. If he fails so to do, and no reasonable cause for such failure is shown, the collision shall, in the absence of proof to the contrary, be deemed to have been caused by his wrongful act, neglect, or default.

Sec. 2. That every master or person in charge of a United States vessel who fails, without reasonable cause, to render such assistance or give such information as aforesaid shall be deemed guilty of a misdemeanor, and shall be liable to a penalty of one thousand dollars, or imprisonment for a term not exceeding two years; and for the above sum the vessel shall be liable and may be seized and proceeded against by process in any district court of the United States by any person; one-half such sum to be payable to the informer and the other half to the United States.

Sec. 3. That this act shall take effect at a time to be fixed by the President by Proclamation issued for that purpose.

Approved, September 4, 1890. Proclamation dated November 18, 1890, to take effect December 15, 1890.

Sunrise and Sunset.

By this table the apparent time of the sun's rising and setting, and the length of the day and night, may be determined.

	DECLINATION.															
LAT.	0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°
°	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m	h.m.	h.m.	h.m.	h.m.	h. m.
0	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00
5	6 00	6 01	6 01	6 02	6 03	6 04	6 04	6 05	6 06	6 07	6 07	6 08	6 09	6 10	6 11	6 12
10	6 00	6 01	6 03	6 04	6 06	6 07	6 09	6 10	6 12	6 13	6 15	6 16	6 18	6 20	6 22	6 23
15	6 00	6 02	6 04	6 06	6 09	6 11	6 13	6 15	6 18	6 20	6 22	6 25	6 27	6 30	6 33	6 36
20	6 00	6 03	6 06	6 09	6 12	6 15	6 18	6 21	6 24	6 27	6 30	6 34	6 37	6 41	6 45	6 49
25	6 00	6 04	6 07	6 11	6 15	6 19	6 23	6 27	6 31	6 35	6 39	6 43	6 48	6 53	6 57	7 02
30	6 00	6 05	6 09	6 14	6 19	6 23	6 28	6 33	6 38	6 43	6 49	6 54	7 00	7 05	7 12	7 18
35	6 00	6 06	6 11	6 17	6 23	6 28	6 34	6 40	6 46	6 53	6 59	7 06	7 13	7 20	7 27	7 35
40	6 00	6 07	6 13	6 20	6 27	6 34	6 41	6 48	6 56	7 03	7 11	7 19	7 28	7 37	7 46	7 56
45	6 00	6 08	6 16	6 24	6 32	6 41	6 49	6 58	7 07	7 16	7 25	7 35	7 46	7 57	8 08	8 21
50	6 00	6 10	6 19	6 29	6 39	6 49	6 59	7 09	7 20	7 31	7 43	7 55	8 08	8 22	8 37	8 54
55	6 00	6 11	6 23	6 35	6 46	6 58	7 11	7 23	7 37	7 51	8 05	8 21	8 38	8 57	9 18	9 42
60	6 00	6 14	6 28	6 42	6 56	7 11	7 26	7 42	7 59	8 17	8 36	8 58	9 22	9 51	10 28	12 00
65	6 00	6 17	6 34	6 52	7 10	7 29	7 48	8 09	8 32	8 57	9 25	10 00	10 51			
70	6 00	6 22	6 44	7 07	7 31	7 56	8 23	8 53	9 28	10 13	12 00					

LATITUDE AND DECLINATION OF SAME NAME.

When the latitude and declination are of same name, the table gives the apparent time of sunset. To find the time of sunrise, subtract the time of setting from 12h 00m.

LATITUDE AND DECLINATION OF DIFFERENT NAME.

When the latitude and declination are of different name, the table gives the apparent time of sunrise. To find the time of sunset, subtract the time of rising from 12h 00m.

Double the time of sunset will give the length of the day.

Double the time of sunrise will give the length of the night.

TABLES FOR TURNING LONGITUDE INTO TIME AND THE CONTRARY.

Longitude into Time.

°	H.	M.	°	H.	M.	°	H.	M.
′	M.	S.	′	M.	S.	′	M.	S.
1	0	04	61	4	04	121	8	04
2	0	08	62	4	08	122	8	08
3	0	12	63	4	12	123	8	12
4	0	16	64	4	16	124	8	16
5	0	20	65	4	20	125	8	20
6	0	24	66	4	24	126	8	24
7	0	28	67	4	28	127	8	28
8	0	32	68	4	32	128	8	32
9	0	36	69	4	36	129	8	36
10	0	40	70	4	40	130	8	40
11	0	44	71	4	44	131	8	44
12	0	48	72	4	48	132	8	48
13	0	52	73	4	52	133	8	52
14	0	56	74	4	56	134	8	56
15	1	00	75	5	00	135	9	00
16	1	04	76	5	04	136	9	04
17	1	08	77	5	08	137	9	08
18	1	12	78	5	12	138	9	12
19	1	16	79	5	16	139	9	16
20	1	20	80	5	20	140	9	20
21	1	24	81	5	24	141	9	24
22	1	28	82	5	28	142	9	28
23	1	32	83	5	32	143	9	32
24	1	36	84	5	36	144	9	36
25	1	40	85	5	40	145	9	40
26	1	44	86	5	44	146	9	44
27	1	48	87	5	48	147	9	48
28	1	52	88	5	52	148	9	52
29	1	56	89	5	56	149	9	56
30	2	00	90	6	00	150	10	00
31	2	04	91	6	04	151	10	04
32	2	08	92	6	08	152	10	08
33	2	12	93	6	12	153	10	12
34	2	16	94	6	16	154	10	16
35	2	20	95	6	20	155	10	20
36	2	24	96	6	24	156	10	24
37	2	28	97	6	28	157	10	28
38	2	32	98	6	32	158	10	32
39	2	36	99	6	36	159	10	36
40	2	40	100	6	40	160	10	40
41	2	44	101	6	44	161	10	44
42	2	48	102	6	48	162	10	48
43	2	52	103	6	52	163	10	52
44	2	56	104	6	56	164	10	56
45	3	00	105	7	00	165	11	00
46	3	04	106	7	04	166	11	04
47	3	08	107	7	08	167	11	08
48	3	12	108	7	12	168	11	12
49	3	16	109	7	16	169	11	16
50	3	20	110	7	20	170	11	20
51	3	24	111	7	24	171	11	24
52	3	28	112	7	28	172	11	28
53	3	32	113	7	32	173	11	32
54	3	36	114	7	36	174	11	36
55	3	40	115	7	40	175	11	40
56	3	44	116	7	44	176	11	44
57	3	48	117	7	48	177	11	48
58	3	52	118	7	52	178	11	52
59	3	56	119	7	56	179	11	56
60	4	00	120	8	00	180	12	00

Example: Turn 73° 53′ 42″ into time.

73°	=	4h.	52m.
53′	=	3	32s
42′	=		2.8
Ans.		4	55 34.8

Time into Longitude.

Time. Hours.	Arc. Degrees.
1	15
2	30
3	45
4	60
5	75
6	90
7	105
8	120
9	135
10	150
11	165
12	180

Time. Minutes.	Arc. Deg.	Arc. Min.
1	0	15
2	0	30
3	0	45
4	1	00
5	1	15
6	1	30
7	1	45
8	2	00
9	2	15
10	2	30
11	2	45
12	3	00
13	3	15
14	3	30
15	3	45
16	4	00
17	4	15
18	4	30
19	4	45
20	5	00
21	5	15
22	5	30
23	5	45
24	6	00
25	6	15
26	6	30
27	6	45
28	7	00
29	7	15
30	7	30
31	7	45
32	8	00
33	8	15
34	8	30
35	8	45
36	9	00
37	9	15
38	9	30
39	9	45
40	10	00
41	10	15
42	10	30
43	10	45
44	11	00
45	11	15
46	11	30
47	11	45
48	12	00
49	12	15
50	12	30
51	12	45
52	13	00
53	13	15
54	13	30
55	13	45
56	14	00
57	14	15
58	14	30
59	14	45
60	15	00

Time. Seconds.	Arc. Min.	Arc. Sec.
1	0	15
2	0	30
3	0	45
4	1	00
5	1	15
6	1	30
7	1	45
8	2	00
9	2	15
10	2	30
11	2	45
12	3	00
13	3	15
14	3	30
15	3	45
16	4	00
17	4	15
18	4	30
19	4	45
20	5	00
21	5	15
22	5	30
23	5	45
24	6	00
25	6	15
26	6	30
27	6	45
28	7	00
29	7	15
30	7	30
31	7	45
32	8	00
33	8	15
34	8	30
35	8	45
36	9	00
37	9	15
38	9	30
39	9	45
40	10	00
41	10	15
42	10	30
43	10	45
44	11	00
45	11	15
46	11	30
47	11	45
48	12	00
49	12	15
50	12	30
51	12	45
52	13	00
53	13	15
54	13	30
55	13	45
56	14	00
57	14	15
58	14	30
59	14	45
60	15	00

Example: Turn 3h 11m 17s into arc.

3h	=	45°		
11m	=	2	45′	
17s	=		4	15″
Ans.		47	49	15

WETTERSTEDT'S COPPER PAINT.

THE FIRST COPPER PAINT MADE.

Patented England, 1846. France, 1847. United States, Aug. 5, 1851.

BEING FINELY GROUND, IT IS EASY TO APPLY, MAKING A SMOOTH SURFACE.

TABLE FOR REDUCING SIDEREAL TO MEAN TIME AND VICE VERSA.

MEAN SOLAR INTO SIDEREAL TIME. To be added to a Mean Time interval.						SIDEREAL INTO MEAN SOLAR TIME. To be subtracted from a Sidereal Time interval.					
h.	m s.	m.	s.	s.	s.	h.	m. s.	m	s.	s.	s.
1	0 9.856	1	0.164	1	0.003	1	0 9.830	1	0.164	1	0.003
2	0 19.713	2	0.329	2	0.005	2	0 19.659	2	0.328	2	0.005
3	0 29.569	3	0.493	3	0.008	3	0 29.489	3	0.491	3	0.008
4	0 39.426	4	0.657	4	0.011	4	0 39.318	4	0.655	4	0.011
5	0 49.282	5	0.821	5	0.014	5	0 49.148	5	0.819	5	0.014
6	0 59.139	6	0.986	6	0.016	6	0 58.977	6	0.983	6	0.016
7	1 08.995	7	1.150	7	0.019	7	1 08.807	7	1.147	7	0.019
8	1 18.852	8	1.314	8	0.022	8	1 18.636	8	1.311	8	0.022
9	1 28.708	9	1.478	9	0.025	9	1 28.466	9	1.474	9	0.025
10	1 38.565	10	1.643	10	0.027	10	1 38.296	10	1.638	10	0.027
11	1 48.421	11	1.807	11	0.030	11	1 48.125	11	1.802	11	0.030
12	1 58.278	12	1.971	12	0.033	12	1 57.955	12	1.966	12	0.033
13	2 08.134	13	2.136	13	0.036	13	2 07.784	13	2.130	13	0.035
14	2 17.991	14	2.300	14	0.038	14	2 17.614	14	2.294	14	0.038
15	2 27.847	15	2.464	15	0.041	15	2 27.443	15	2.457	15	0.041
16	2 37.704	16	2.628	16	0.044	16	2 37.273	16	2.621	16	0.044
17	2 47.560	17	2.793	17	0.047	17	2 47.102	17	2.785	17	0.046
18	2 57.417	18	2.957	18	0.049	18	2 56.932	18	2.949	18	0.049
19	3 07.273	19	3.121	19	0.052	19	3 06.762	19	3.113	19	0.052
20	3 17.129	20	3.285	20	0.055	20	3 16.591	20	3.277	20	0.055
21	3 26.986	21	3.450	21	0.057	21	3 26.421	21	3.440	21	0.057
22	3 36.842	22	3.614	22	0.060	22	3 36.250	22	3.604	22	0.060
23	3 46.699	23	3.778	23	0.063	23	3 46.080	23	3.768	23	0.063
24	3 56.555	24	3.943	24	0.066	24	3 55.910	24	3.932	24	0.066
		25	4.107	25	0.068			25	4.096	25	0.068
		26	4.271	26	0.071			26	4.259	26	0.071
		27	4.435	27	0.074			27	4.423	27	0.074
		28	4.600	28	0.077			28	4.587	28	0.076
		29	4.764	29	0.079			29	4.751	29	0.079
		30	4.928	30	0.082			30	4.915	30	0.082
		31	5.093	31	0.085			31	5.079	31	0.085
		32	5.257	32	0 088			32	5.242	32	0.087
		33	5.421	33	0.090			33	5.406	33	0.090
		34	5.585	34	0.093			34	5.570	34	0.093
		35	5.750	35	0.096			35	5.734	35	0.096
		36	5.914	36	0.099			36	5.898	36	0.098
		37	6.078	37	0.101			37	6.062	37	0.101
		38	6.242	38	0.104			38	6.225	38	0.104
		39	6.407	39	0.107			39	6.389	39	0.106
		40	6.571	40	0.110			40	6.553	40	0.109
		41	6.735	41	0.112			41	6.717	41	0.112
		42	6.900	42	0.115			42	6.881	42	0.115
		43	7.064	43	0.118			43	7.045	43	0.117
		44	7.228	44	0.120			44	7.208	44	0.120
		45	7.392	45	0.123			45	7.372	45	0.123
		46	7.557	46	0.126			46	7.536	46	0.126
		47	7.721	47	0.129			47	7.700	47	0.128
		48	7.885	48	0.131			48	7.864	48	0.131
		49	8.049	49	0.134			49	8.027	49	0.134
		50	8.214	50	0.137			50	8.191	50	0.137
		51	8.378	51	0.140			51	8.355	51	0.139
		52	8.542	52	0.142			52	8.519	52	0.142
		53	8.707	53	0.145			53	8.683	53	0 145
		54	8.871	54	0.148			54	8.847	54	0.147
		55	9.035	55	0.151			55	9.010	55	0.150
		56	9.199	56	0.153			56	9.174	56	0.153
		57	9.364	57	0.156			57	9 338	57	0.156
		58	9.528	58	0.159			58	9.502	58	0.158
		59	9.692	59	0.162			59	9.666	59	0.161
		60	9.857	60	0.165			60	9.830	60	0.164

"NEW JERSEY"

No. 1

Anti-Corrosive Paint

No. 2

Anti-Fouling Paint

First Coat.

For Iron and Steel Vessels

1

"New Jersey"

Anti-Corrosive Paint

Finishing Coat.

For Iron and Steel Vessels

2

"New Jersey"

Anti-Fouling Paint

Protecting Vessels from Barnacles and Grass.

To be applied as a Finishing Coat on bottoms of Steel and Iron Vessels.

"NEW JERSEY"

Mixed Marine Paints

being QUICK DRYING, are desirable for vessels; for what can be more annoying about a vessel than to have paint applied that is slow drying?

Weight of Various Substances.

The following table contains the weight per cubic foot of several substances which may enter into a ship as cargo, ballast or part of the structure and will facilitate the calculation of weights and magnitudes.

To find the weight of any quantity of any particular substance, find the number of cubic feet or inches it contains and multiply that quantity by the number found in the table corresponding to the material in question, and the product will be the weight in pounds.

If the weight is known and the volume is wanted, divide the whole weight by the weight per cubic foot and the result will be the volume.

On account of the variations of the weight per cubic foot of different specimens of the same substances, the results obtained by using the tabulated number cannot be looked upon as exactly correct. However, they are sufficiently so for the purposes intended, as indicated by the following examples.

The table of areas of circles will be found useful in determining the weight or volume of circular bodies.

The following problems illustrate the use of the tables:

Example: Find the weight of a steel shaft 16 feet long and 15 inches diameter. It will be noticed that the length of this shaft is given in feet and the diameter in inches. The area for 15 inches may be taken from the table and multiplied by the length in inches, or the area for 15 inches may be divided by 144 (the number of inches in a square foot), which will give the area in feet, and is then multiplied by the length in feet.

Area 15 inches	=	176.7146
Length 16 feet in inches	=	× 192
		3534292
		15904314
		1767146
Cubic inches in shaft	=	33929.2032

and is reduced to cubic feet by dividing it by 1728 (the number of cubic inches in one cubic foot).

1728)33929.20(19.63 = cubic feet
1728
16649
15552
10972
10368
6040
5184
856

Cubic feet in shaft	=	19.63
Weight in pounds of one cubic foot of steel	=	× 489
		17667
		15704
		7852
Weight of shaft in pounds	=	9599.07

and is reduced to tons by dividing it by 2240 (the number of pounds in a long ton).

2240)9599.07(4.28
8960
6390
4480
19107
17920
1187

Weight of shaft = 4.28 tons.

Example: A cylindrical tank 5 feet in diameter and 9 feet high is filled with fresh water. Find the weight and number of gallons it contains.

Area 5 feet	=	19.635
Altitude of tank	=	× 9
Cubic feet in tank	=	176.715
Gallons in one cubic foot	=	× 7.48
		1413720
		706860
		1237005
Gallons in tank	=	1321.82820

Cubic feet in tank	=	176.715
Weight of one cubic foot water	=	× 62.425
		883575
		353430
		706860
		353430
		1060290
Weight of water in pounds	=	11031.433875

and is reduced to tons by dividing by 2240.

```
2240)11031.434(4.924 = tons
  8960
  20714
  20160
   5543
   4480
  10634
   8960
   1674
```

The weight can be obtained by dividing the cubic feet by 35.88 (the number of cubic feet in one ton of water) and is more convenient.

Example: A mahogany log measures 23x4x3½ feet. Find its weight in tons.

```
Length in feet                  =    23
Breadth in feet                 = × 4
                                    92
Depth in feet                     × 3.5
                                   460
                                   276
Cubic feet in log               = 322.0
Weight of one cubic foot =        × 53
                                   966
                                  1600
Weight of log 7.57 tons         = 16966 (pounds)
```

Example: Find the weight of a cast iron pipe of the following dimensions. Inside diameter, 5 feet. Outside diameter, 5 feet 2 inches. Length, 12 feet.

```
Outside diameter, 5 feet 2 inches = 62 inches area  =  3019.07
Inside     "     5   "   0   "    = 60   "     "    =  2827.43
Circum. mean diameter, 62 inches                     =   191.64
Length of pipe, 12 feet = 144 inches                 =  × 144
                                                        76656
                                                        76656
                                                        19164
Cubic inches of material                             = 27596.16
```

and is reduced to cubic feet by dividing by 1728 (the number of cubic inches in one cubic foot).

```
1728)27596.16(15.97 cubic feet.
  1728
  10316
   8640
  16761
  15552
   12096
   12096
```

```
Cubic feet of iron in pipe                          =   15.97
Weight of one cubic foot of cast iron in pounds     =  × 450
                                                       79850
                                                        6388
Weight of pipe in pounds                            = 7186.50
```

Example: A block of granite is 3 feet long, 3 feet wide and 2 feet thick. Find its weight

```
18 cubic feet = 3×3×2
Weight of one cubic foot in pounds  =   169
Cubic feet in block                 = × 18
                                      1352
                                       169
Weight of block in pounds           =  3042
```

Example: A bunker measures 25 feet in length, 15 feet in width and 14 feet in depth. How many tons of soft coal will it hold? Taking the weight of one cubic foot of bituminous coal from the table and dividing 2240 by it, will give the number of cubic feet in one ton. In using the weight given in the table, some judgment must be exercised as it is somewhat above the mean value, as some coal will measure 35 cubic feet to the ton, while other grades may go beyond 47 cubic feet. The number in the table is for a grade of coal measuring 43 cubic feet to the ton.

$$\text{Capacity of bunker in tons} = 122.09 = \frac{25\times15\times14}{43}$$

If desired, logarithms may be introduced to shorten calculations of this nature.

```
Length 25 feet              = log.  1.39794
Width  15  "                =  "    1.17609
Depth  14  "                =  "    1.14613
Capacity 525 cubic feet     =  "    3.72016
Cubic feet in one ton, 43   =  "    1.63347
Bunker capacity, 122.09 tons =  "   2.08669
```

Table of Weight of Various Substances.

Name of Substance	Weight in Pounds per Cubic Foot	Name of Substance	Weight in Pounds per Cubic Foot
Aluminum	156	Magnesia	46
Ambergris	58	Mahogany	53
Ash (wood)	47	Manganese	500
Beech	43	Marble, common	168
Beeswax	60	" Italian	169
Bronze, gun metal	543	" Parian	177
Brick	119	" Vermont	177
Brass	488	Oak, live	60
Cedar	37	" white	49
Chalk	174	Olive oil	57
Charcoal	28	Palm oil	49
Clay	120	Petroleum, crude	56
Coal, anthracite, avg	55	" refined	50
" bituminous, "	52	Pine, white	25
Coke	30	" yellow	44
Copper	549	Pitch	72
Coral	167	Plaster of Paris	154
Cork	15	Rosin	70
Cryolite	184	Salt, common	133
Cypress	37	Saltpeter	130
Earth, loose	94	Sand	165
Elm	35	Slate	167
Emery	250	Spruce	34
Glass	183	Steel	489
Granite	169	Stone, common	157
Grindstone	134	" pumice	57
Gypsum, opaque	135	Sugar	100
Hackmatack	37	Sulphur	127
Hemlock, dry	27	Tallow	59
Ice	57	Tar, pine	61
Iron, cast	450	Teakwood	47
" wrought	486	Tin	456
Lard	59	Turpentine	54
Lead	707	Water, fresh, 39.2 F	62.425
Lignum-vitæ	83	" New York Harbor	63
Lime, quick	76	" sea, avg	64
Limestone	185	Whale oil	58
Linseed oil	59	Wine	62
Logwood	57	Zinc	449

Fresh Water.

UNITED STATES GALLON.

$$\text{Tons} = \frac{\text{gallons}}{268.365} \qquad \text{Tons} = \frac{\text{cubic feet}}{35.883}$$

Pounds = cubic feet × 62.425
Gallons = cubic feet × 7.48
Pressure = height in feet × .4335
Height in feet = pressure × 2.3093

			Logarithm.
1 ton	contains	35.883 cubic feet	1.55489
1 "	"	268.365 gallons	2.56628
1 "	weighs	2240 pounds	3.35025
1 gallon	contains	231 cubic inches	2.36361
1 "	"	.833 imperial gallon	2.92065
1 "	weighs	8.33 pounds	.92065
1 quart	"	2.08 "	.31806
1 pint	"	1.04 "	.01703
1 gill	"	.26 "	9.41497
1 cubic foot	"	62.425 "	1.79536
1 " "	contains	7.48 gallons	.87390
1 " "	"	1728 cubic inches	3.23754
1 " inch	weighs	.036125 pounds	8.55781
12 " inches	"	.4335 "	9.63699
27.71 cubic "	"	1 "	
27.71 " "	height	2.3093 feet	.36348

IMPERIAL GALLON.

1 ton	contains	223.55 gallons	1.34938
1 gallon	"	277.274 cubic inches	2.44291
1 "	"	1.2 U. S. gallons	.07918
1 "	weighs	10.016 pounds	1.00069
1 cubic foot	contains	6.23 gallons	.79449

Metric System.

METRIC CONVERSION TABLE.

LINEAR MEASURE.

DENOMINATION	ABBR.	VALUE
Myriameter	.....	10000 meters
Kilometer	km.	1000 "
Hectometer	.....	100 "
Dekameter	.....	10 "
Meter	m.	1 "
Decimeter	dm.	.1 "
Centimeter	cm.	.01 "
Millimeter	mm.	.001 "

MEASURE OF VOLUME.

DENOMINATION	ABBR.	VALUE
Kiloliter	.....	1000 liters
Stere	s.	" "
Cubic Meter	$m.^3$	" "
Hectoliter	hl.	100 "
Dekaliter	dal	10 "
Cubic Decimeter	$dm.^3$	1 "
Liter	l.	1 "
Deciliter	dl.	.1 "
Centiliter	cl.	.01 "
Cubic Centimeter	$cm.^3$	.001
Milliliter	ml.	.001 liter
Cubic Millimeter	$mm.^3$	.000001 "
Microliter	λ	.001 m. l.

MEASURE OF SURFACE.

DENOMINATION	ABBR.	VALUE
Sq. Kilometer	$km.^2$	1000000 $m.^2$
Hektar	ha.	10000 $m.^2$
Are	a	100 $m.^2$
Centare	.....	1 $m.^2$
Square Meter	$m.^2$	1 $m.^2$
Sq. Decimeter	$dm.^2$	.01 $m.^2$
Sq. Centimeter	$m.^2$	.0001 $m.^2$
Sq. Millimeter	$mm.^2$	.000001 $m.^2$

MEASURE OF MASS.

DENOMINATION	ABBR.	VALUE
Millier	.....	1000 kilos
Tonneau	.....	" "
Metric Ton	t.	" "
Quintal	.....	100 "
Myriagram	.....	10 "
Kilogram	kg.	1000 grams
Kilo	.....	" "
Hectogram	.....	100 "
Dekagram	.....	10 "
Gram	g.	1 "
Decigram	dg.	.1 "
Centigram	cg.	.01 "
Milligram	mg	.001 "
Microgram	y.	.001 m. g.

Millimeters	×	.03937	=	inches.
"	÷	25.4	=	"
Centimeters	×	.3937	=	"
"	÷	2.54	=	"
Meters	×	39.37	=	(Act of Congress.)
"	×	3.281	=	feet.
"	×	1.094	=	yards.
Kilometers	×	.621	=	miles.
"	÷	1.6093	=	"
"	×	3280.7	=	feet.
Square Millimeters	×	.00155	=	square inches.
" "	÷	645.1	=	" "
Square Centimeters	×	.155	=	" "
" "	÷	6.451	=	" "
Square Meters	×	10.764	=	" feet.
Square Kilometers	×	247.1	=	acres.
Hektares	×	2.471	=	acres.
Cubic Centimeters	÷	16.383	=	cubic inches.
" "	÷	3.69	=	fluid drachms.
" "	÷	29.57	=	fluid ounce.
" Meters	×	35.315	=	cubic feet.
" "	×	1.308	=	cubic yards.
" "	×	264.2	=	gallons (231 cu. in.).
Liters	×	61.022	=	cubic inches (Act of Congress).
"	×	33.84	=	fluid ounce (U. S. Phar.).
"	×	.2642	=	gallons (231 cu. in.).
"	÷	3.78	=	" " "
"	÷	28.316	=	cubic feet.
Hectoliters	×	3.531	=	" "
"	×	2.84	=	bushels (2150.42 cu. in.).
"	×	.131	=	cubic yards.
"	×	26.42	=	gallons (231 cu. in.).
Grams	×	15.432	=	grains (Act of Congress).
"	×	981	=	dynes.
" (water)	÷	29.57	=	fluid ounces.
"	÷	28.35	=	ounces avoirdupois.
" per cu. cent.	÷	27.7	=	pounds per cubic inches.
Joule	×	.7373	=	foot-pounds.
Kilograms	×	2.2046	=	pounds.
"	×	35.3	=	ounce, avoirdupois.
"	÷	907.2	=	tons (2000 lbs.).
" per sq. cent.	×	14.223	=	pounds per sq. in.
Kilogrammeters	×	7.233	=	foot-pounds.
Kilograms per lineal meter	×	.672	=	pounds per lineal foot.
" " square "	×	.205	=	pounds per square foot.
" " cubic "	×	.062	=	pounds per cubic foot.
" " cheval-vapeur	×	2.235	=	pounds per H. P.
Kilo-watts	×	1.34	=	horse-power.
Watts	÷	746	=	"
"	×	.7373	=	foot-pounds per second.
Calorie	×	3.968	=	B. T. U.
Cheval-vapeur	×	.9863	=	horse-power.
(Deg. Centigrade	×	1.8) + 32	=	degrees Fahrenheit.
Francs	×	.193	=	dollars.
Gravity, Paris	=	980.94		centimeters per second.
1 Admiralty knot	=	1.853		kilometers.

1 Atmosphere is the pressure of a column of 76 centimeters of mercury at the temperature of melting ice at Paris, where it is equal to 1.0333 kilos on a square centimeter.

Length of Circular Arcs.

°	Length.	°	Length.	′	Length.	′	Length.
1	.01745329	10	.17453293	1	.00029089	10	.00290888
2	.03490659	20	.34906585	2	.00058078	15	.00436332
3	.05235988	30	.52359878	3	.00087266	20	.00581776
4	.06981317	40	.69813170	4	.00116455	30	.00872665
5	.08726646	50	.87266463	5	.00145444	40	.01163553
6	.10471976	60	1.04719755	6	.00174533	45	.01308997
7	.12217305	70	1.22173048	7	.00203622	50	.01454441
8	.13962634	80	1.39626340	8	.00232711	55	.01599885
9	.15707963	90	1.57079633	9	.00261799	1°	.01745329

The above table contains the length of the degree and minute of arc, the radius of the circle being one, and when the radius is different, multiply the corresponding number by it.

Example: Find the length of 37° 42′, the radius being 9 inches.

30°	=	.52359878
7°	=	.12217305
40′	=	.01163553
2′	=	.00058078
		.65798814
Radius	=	× 9
Length of 37° 42′	=	5.92189326

Example: Find the length of 23° 30′, the radius 22 feet.

20°	=	.34906585
3°	=	.05235988
30′	=	.00872665
		.41015238
		22
		82030476
		82030476
		9.02335236

The same result may be obtained by dividing the circumference by 360° and multiplying the quotient by the degrees and decimal parts of a degree, and is written:

$$9.02335 + = \frac{138.2301}{360} \times 23°.5$$

The Teredo Worm.

There are several species of teredo worm in the United States, but the one we consider most harmful is generally known as Teredo navalis, a marine wood borer which is and has been for many years ravaging timber structures and ship bottoms in salt water.

The teredo worm, as generally found, is from 6 to 16 inches long, and of a diameter from ¼ to ½ inch, with a smooth, translucent body of a substance similar to that of a clam or oyster. At one end it is equipped with a boring shell and at the other end are the separate extremities of two tubes which are continuous through the body, one serving to take in, from the outside, air, water and food for the support of the animal, and the other to carry out the refuse, due both to the boring and the physical processes which sustain its life. These tube terminals are kept at the exterior of the timber, where the teredo worm first enters, and keeps up communication with the outer water. When the teredo worm enters a piece of wood, it is very small, about the size of a small pinhead, but it enlarges soon after entry and develops rapidly. The most noticeable points of the animal are these: it must always command the opening to the water and it objects to crossing a track; on the latter account it does not readily attack piles on which the bark has been retained, avoiding the junction between the bark and the wood.

In order to limit the destructive action of this animal on the bottoms of ships various protective devices have been tried, but only copper paint as a protective coat has been found effective; other poisonous paints are affected by salt water and other conditions, and after much experimenting, experience has proven that a properly compounded copper paint has been a great success.

Fractions of an Inch in Decimals.

Fraction of an Inch.	Decimal of an Inch.	Fraction of an Inch.	Decimal of an Inch.	Fraction of an Inch.	Decimal of an Inch.	Fraction of an Inch.	Decimal of an Inch.
1-64	.01562	17-64	.26562	33-64	.51562	49-64	.76562
1-32	.03125	9-32	.28125	17-32	.53125	25-32	.78125
3-64	.04687	19-64	.29687	35-64	.54687	51-64	.79687
1-16	.06250	5-16	.31250	9-16	.56250	13-16	.81250
5-64	.07812	21-64	.32812	37-64	.57812	53-64	.82812
3-32	.09375	11-32	.34375	19-32	.59375	27-32	.84375
7-64	.10937	23-64	.35937	39-64	.60937	55-64	.85937
1-8	.12500	3-8	.37500	5-8	.62500	7-8	.87500
9-64	.14062	25-64	.39062	41-64	.64062	57-64	.89062
5-32	.15625	13-32	.40625	21-32	.65625	29-32	.90625
11-64	.17187	27-64	.42187	43-64	.67187	59-64	.92187
3-16	.18750	7-16	.43750	11-16	.68750	15-16	.93750
13-64	.20312	29-64	.45312	45-64	.70312	61-64	.95312
7-32	.21875	15-32	.46875	23-32	.71875	31-32	.96875
15-64	.23437	31-64	.48437	47-64	.73437	63-64	.98437
1-4	.25000	1-2	.50000	3-4	.75000	1 inch	1.00000

Areas and Circumferences of Circles.

Diameter.	Area.	Circumference.	Diameter.	Area.	Circumference.
1	.7854	3.1416	51	2042.8206	160.2212
2	3.1416	6.2832	52	2123.7166	163.3628
3	7.0686	9.4248	53	2206.1834	166.5044
4	12.5664	12.5664	54	2290.2210	169.6460
5	19.6350	15.7080	55	2375.8294	172.7876
6	28.2743	18.8496	56	2463.0086	175.9292
7	38.4845	21.9911	57	2551.7586	179.0708
8	50.2655	25.1327	58	2642.0794	182.2184
9	63.6173	28.2743	59	2733.9710	185.3540
10	78.5398	31.4159	60	2827.4334	188.4956
11	95.0332	34.5575	61	2922.4666	191.6372
12	113.0973	37.6991	62	3019.0706	194.7787
13	132.7323	40.8407	63	3117.2453	197.9203
14	153.9380	43.9823	64	3216.9909	201.0619
15	176.7146	47.1239	65	3318.3072	204.2035
16	201.0619	50.2655	66	3421.1944	207.3451
17	226.9801	53.4071	67	3525.6524	210.4867
18	254.4690	56.5487	68	3631.6811	213.6283
19	283.5287	59.6903	69	3739.2807	216.7699
20	314.1593	62.8319	70	3848.4510	219.9115
21	346.3606	65.9734	71	3959.1921	223.0531
22	380.1327	69.1150	72	4071.5041	226.1947
23	415.4756	72.2566	73	4185.3868	229.3363
24	452.3893	75.3982	74	4300.8403	232.4779
25	490.8739	78.5398	75	4417.8647	235.6194
26	530.9292	81.6814	76	4536.4598	238.7610
27	572.5553	84.8230	77	4656.6257	241.9026
28	615.7522	87.9646	78	4778.3624	245.0442
29	660.5199	91.1062	79	4901.6699	248.1858
30	706.8583	94.2478	80	5026.5482	251.3274
31	754.7676	97.3894	81	5152.9974	254.4690
32	804.2477	100.5310	82	5281.0173	257.6106
33	855.2986	103.6726	83	5410.6079	260.7522
34	907.9203	106.8142	84	5541.7694	263.8938
35	962.1128	109.9557	85	5674.5017	267.0354
36	1017.8760	113 0973	86	5808.8048	270.1770
37	1075.2101	116 389	87	5944.6787	273.3186
38	1134.1149	119.3805	88	6082.1234	276.4602
39	1194.5906	122.5221	89	6221.1389	279.6017
40	1256.6371	125.6637	90	6361.7251	282.7434
41	1320.2543	128.8053	91	6503.8822	285.8849
42	1385.4424	131.9469	92	6647.6101	289.0265
43	1452.2012	135.0835	93	6792.9097	292.1681
44	1520.5308	138.2301	94	6939.7782	295.3097
45	1590.4313	141.3717	95	7088.2184	298.4513
46	1661.9025	144.5133	96	7238.2295	301.5929
47	1734.9445	147.6549	97	7389.8113	304.7345
48	1809.5574	150.7964	98	7542.9640	307.8761
49	1885.7410	153.9380	99	7697.6874	311.0177
50	1963.4954	157.0796	100	7853.9816	314.1593

Inches and Fractions in Decimals of a Foot.

Parts of Foot in inches and Fractions.	Decimal of a Foot.	Parts of Foot in inches and Fractions.	Decimal of a Foot.	Parts of Foot in inches and Fractions.	Decimal of a Foot.	Parts of Foot in inches and Fractions.	Decimal of a Foot.
1-16	.00520	3 1-16	.25520	6 1-16	.50520	9 1-16	.75520
1-8	.01040	3 1-8	.26040	6 1-8	.51040	9 1-8	.76040
3-16	.01562	3 3-16	.26562	6 3-16	.51562	9 3-16	.76562
1-4	.02080	3 1-4	.27080	6 1-4	.52080	9 1-4	.77080
5-16	.02600	3 5-16	.27600	6 5-16	.52600	9 5-16	.77600
3-8	.03125	3 3-8	.28125	6 3-8	.53125	9 3-8	.78125
7-16	.03640	3 7-16	.28650	6 7-16	.53640	9 7-16	.78650
1-2	.04170	3 1-2	.29170	6 1-2	.54170	9 1-2	.79170
9-16	.04687	3 9-16	.29687	6 9-16	.54687	9 9-16	.79687
5-8	.05210	3 5-8	.30210	6 5-8	.55210	9 5-8	.80210
11-16	.05730	3 11-16	.30730	6 11-16	.55730	9 11-16	.80730
3-4	.06250	3 3-4	.31250	6 3-4	.56250	9 3-4	.81250
13-16	.06770	3 13-16	.31770	6 13-16	.56770	9 13-16	.81770
7-8	.07290	3 7-8	.32290	6 7-8	.57290	9 7-8	.82290
15-16	.07812	3 15-16	.32812	6 15-16	.57812	9 15-16	.82812
1 inch	.08330	4 inches	.33330	7 inches	.58330	10 inches	.83330
1 1-16	.08850	4 1-16	.33850	7 1-16	.58850	10 1-16	.83850
1 1-8	.09375	4 1-8	.34375	7 1-8	.59375	10 1-8	.84375
1 3-16	.09900	4 3-16	.34900	7 3-16	.59900	10 3-16	.84900
1 1-4	.10420	4 1-4	.35420	7 1-4	.60420	10 1-4	.85420
1 5-16	.10937	4 5-16	.35937	7 5-16	.60937	10 5-16	.85937
1 3-8	.11460	4 3-8	.36460	7 3-8	.61460	10 3-8	.86460
1 7-16	.11980	4 7-16	.36980	7 7-16	.61980	10 7-16	.86980
1 1-2	.12500	4 1-2	.37500	7 1-2	.62500	10 1-2	.87500
1 9-16	.13020	4 9-16	.38020	7 9-16	.63020	10 9-16	.88020
1 5-8	.13540	4 5-8	.38540	7 5-8	.63540	10 5-8	.88540
1 11-16	.14062	4 11-16	.39062	7 11-16	.64062	10 11-16	.89062
1 3-4	.14580	4 3-4	.39580	7 3-4	.64580	10 3-4	.89580
1 13-16	.15100	4 13-16	.40100	7 13-16	.65100	10 13-16	.90100
1 7-8	.15625	4 7-8	.40625	7 7-8	.65625	10 7-8	.90625
1 15-16	.16150	4 15-16	.41140	7 15-16	.66150	10 15-16	.91150
2 inches	.16670	5 inches	.41670	8 inches	.66670	11 inches	.91670
2 1-16	.17187	5 1-16	.42187	8 1-16	.67187	11 1-16	.92187
2 1-8	.17710	5 1-8	.42710	8 1-8	.67710	11 1-8	.92710
2 3-16	.18230	5 3-16	.43230	8 3-16	.68230	11 3-16	.93230
2 1-4	.18750	5 1-4	.43750	8 1-4	.68750	11 1-4	.93750
2 5-16	.19270	5 5-16	.44270	8 5-16	.69270	11 5-16	.94270
2 3-8	.19790	5 3-8	.44790	8 3-8	.69790	11 3-8	.94790
2 7-16	.20312	5 7-16	.45312	8 7-16	.70312	11 7-16	.95312
2 1-2	.20830	5 1-2	.45830	8 1-2	.70830	11 1-2	.95830
2 9-16	.21350	5 9-16	.46350	8 9-16	.71350	11 9-16	.96350
2 5-8	.21875	5 5-8	.46875	8 5-8	.71875	11 5-8	.96875
2 11-16	.22400	5 11-16	.47400	8 11-16	.72400	11 11-16	.97400
2 3-4	.22920	5 3-4	.47920	8 3-4	.72920	11 3-4	.97920
2 13-16	.23437	5 13-16	.48437	8 13-16	.73437	11 13-16	.98437
2 7-8	.23950	5 7-8	.48960	8 7-8	.73960	11 7-8	.98960
2 15-16	.24480	5 15-16	.49480	8 15-16	.74480	11 15-16	.99480
3 inches	.25000	6 inches	.50000	9 inches	.75000	12 inches	1.00000

The National Flag.

The official flag of the United States bears forty-eight stars in a blue field, arranged in six rows having eight stars each. The garrison flag of the Army is made of bunting, thirty-six fly and twenty feet hoist; thirteen stripes, and in the upper quarter, next the staff, is the field or "union" of stars, equal to the number of States, on blue field, over one-third length of the flag, extending to the lower edge of the fourth red stripe from the top. The storm flag is twenty feet by ten feet and the recruiting flag is nine feet nine inches by four feet four inches. The "American Jack" is the "union" or blue field of the flag. The Revenue Marine Service flag, authorized by act of Congress, March 2, 1799, was originally prescribed to "consist of sixteen perpendicular stripes, alternate red and white, the union of the ensign bearing the arms of the United States in dark blue on a white field." The sixteen stripes represented the number of States which had been admitted to the Union at that time, and no change has been made since. Prior to 1871 it bore an eagle in the union of the penant, which was then substituted by thirteen blue stars in a white field, but the eagle and stars are still retained in the flag. June 14, the anniversary of the adoption of the National flag, is celebrated as Flag Day in the public schools, and by the display of the emblem on public buildings and private houses in a large part of the Union.

Distance by Sound.

This table shows the velocity of sound in feet per second of time for every second degree of temperature from 20° below zero to 102° above (Fahr.). The temperatures in heavy face type are below zero. The velocity of sound as given in the table is to be used in determining distance. The accuracy of the result depends on the weather being calm.

Deg. Temp. Farh.	Feet per Sec.	Deg. Temp. Fahr.	Feet per Sec.
20	1074	42	1105
18	1075	44	1106
16	1076	46	1107
14	1077	48	1108
12	1078	50	1109
10	1079	52	1110
8	1080	54	1111
6	1081	56	1112
4	1082	58	1113
2	1083	60	1114
Zero	1084	62	1115
2	1085	64	1116
4	1086	66	1117
6	1087	68	1118
8	1088	70	1119
10	1089	72	1120
12	1090	74	1121
14	1091	76	1122
16	1092	78	1123
18	1093	80	1124
20	1094	82	1125
22	1095	84	1126
24	1096	86	1127
26	1097	88	1128
28	1098	90	1129
30	1099	92	1130
32	1100	94	1131
34	1101	96	1132
36	1102	98	1133
38	1103	100	1134
40	1104	102	1135

Example: The flash of a gun was seen, and nine seconds later the report was heard. The temperature was 8° below zero. Find its distance.

Feet per second for 8°	1080
Interval	× 9s
Dist. in feet	9720=1'.6

Example: The vapor from a ship's whistle was seen, and eleven seconds later was heard. Temperature was 88°. Find her distance.

Feet per sec. for 88°	1128
Interval	× 11s
	1128
	1128
Dist. in feet	12408=2'.04

"New Jersey" Copper Paint

Leads Them All.

Being Finely Ground it is Easy to Apply.

The success attending the introduction and sale of "NEW JERSEY" COPPER PAINT has been very remarkable. No other Copper Paint ever received such a rapid introduction, or is so strongly endorsed by Testimonials and Medals. Its guaranteed quality, its fineness, and being easy to apply, has made it greatly liked. It is of such a consistency (not being too thick or too thin) that it freely enters the wood, and at the same time it has body enough to produce a coating on the outside. In its double capacity it so poisons the wood that the worms will not enter, and its coating outside protects it from barnacles, grass, etc.

My long experience in this line has enabled me to produce a Copper Paint of which it can be justly said: "It Leads Them All."

Jersey City,

Mr. H. Louderbough.

Dear Sir.—At our two Dry Docks in Jersey City, during the past season, we have applied to our satisfaction on a large number of Vessels, the New Jersey Copper Paint, and must say our trade has been greatly pleased with the result from the use of your paint. Yours truly, BULMAN & BROWN.

Tottenville, N. Y.,

Mr. H. Louderbough.

Dear Sir.— In the use of your New Jersey Seam Paint we are convinced of its merit. It is easy to work into seams, and as a substitute for pitch is the best we have ever used. It is elastic, very tough and durable. Respectfully yours,

W. H. SMITH & CO.

Perth Amboy,

Mr. H. Louderbough.

Dear Sir.—I take great pleasure endorsing both your New Jersey Seam Paint and your New Jersey Copper Paint. After using about all the Seam and Copper Paints made, it is my judgment that yours is the best I have ever used, your productions always being uniform, not too stout or too thin.

I remain, yours, &c., C. M. WHITAKER.

Seattle, Washington,

Mr. H. Louderbough.

Dear Sir.—In connection with our paint and glass business, we have sold for several years your "New Jersey" Copper Paint in this market and vicinity, and the results have met with the general endorsements that "New Jersey" Copper Paint "Leads them all." Yours truly,

BAKER & RICHARDS.

"NEW JERSEY"

SARGASSO GREEN

NON-FOULING COMPOSITION

The brightest and strongest green non-fouling composition for yacht or vessel bottoms. Can be applied on wood or iron with excellent results

DIRECTIONS FOR USE

Stir thoroughly before using, and apply two coats on bottom bare of paint. In use upon iron bottoms, clean thoroughly and apply one coat of "New Jersey" Anti-Corrosive Paint before applying Sargasso Green.

NEW JERSEY PAINT WORKS,
HARRY LOUDERBOUGH, INC.
JERSEY CITY, N.J. U.S.A.

Finding the Distance Off of any Fixed Object.

When a light is made at night, it is important that the distance off be known as soon as possible. Too frequently the distance is judged or more properly guessed and sometimes leads to disaster. It is often of equal importance to get the distance off of a light-house, point or other object during the day.

The method called the "four point bearing," is generally known to seamen and it has only one objection, that is, it gives the distance off when nearest the danger. However, there are many opportunities for its use when the ship is known to be outside the danger.

As an example, suppose the course is N. by E. and Barnegat light is made bearing N.N.W., which is 3 points on the port bow. How far off will the ship pass the light? On page 100 of the Light House book it is found that Barnegat light is visible 19 miles on a clear night. Enter the table on page 121 of this work with 19 miles and 3 points and it will be found that the ship will be 10.6 miles off when the light is abeam. Because of the continuous and uncertain changes of the atmosphere, this method can only be considered approximate; but will serve as a precaution. If the weather is such that the light is visible less than 19 miles, the ship will pass nearer the light; while if the distance the light is seen is more than 19 miles, the ship will pass the light at a greater distance. Continuing this course, note the reading of the log when the light bears N.W. by N., which will be four points on the bow. When the light is abeam note the reading of the log again. In this case it is found that the ship ran 10.6 miles, which was the distance off when the light was abeam. When the light was abeam, a sounding should be obtained and the depth compared with that on the chart. In this case the depth would be 14 fathoms and fixes the position of the ship with absolute certainty. Continuing on this course, note the log when the light bears S.W. by W., or four points abaft the beam. If the distance then run is less than 10.6 miles it is evident that a current, change in the deviation, or some other influence is setting the ship to port of her course. On the other hand, if the distance run is greater than 10.6 miles, she is being set to starboard of her course.

The only object in taking the bearing abaft the beam is to learn if the ship is making her course good, and if she is the distance must be 10.6 miles or very close to it. When the distances off of lights are obtained, it must be remembered that sometimes light-houses are well inland and the position of the light on the chart should be noticed. Also the least distance the ship can pass the light in safety.

Sometimes a light is made unexpectedly and it is not certain that the ship can stand on that course without danger. The light can be brought abeam and kept there until the original course is reached, when she will have circled part way around the light and clear any possible danger.

As an example, suppose the course to be N. ½ W., and Cape Canaveral light is made bearing N.N.W. The chart shows that the ship is standing into danger, and if the light is brought abeam or a little abaft it at once, the ship will be standing off-shore and out of danger. The course is altered as often as necessary to keep the light nearly abeam until she has the light abeam and heading N. ½ W., when she will be out of danger and may continue on her course. If in a case of this kind it is desired to know the distance of the light at once, bring it abeam, note the course and keep it until the bearing has changed to one point abaft the beam. The distance off at the time of the second bearing will be five times the distance run. In this case, say the ship ran 3.4 miles, changing the bearing one point $3'.4 \times 5 = 17.0$ miles, the distance off at time of second bearing, which according to the chart is a safe distance.

When sailing along high land, the heights of certain peaks are given on the chart, and the distance off may be accurately determined with the sextant and without any great amount of labor.

As an example, suppose the height of a peak or bold cliff is 1500 feet according to the chart. An altitude is observed with the sextant and found to be three degrees. Degrees are near enough in this angle; but as a matter of precaution use the greater degree.

Enter table 2 with the observed altitude as if a course. Find the height of the land in the departure column, and the corresponding number in the latitude column will be the distance off in feet. Divide the distance off by 6080 to reduce it to miles. In this case 15.00 is taken in the departure column, the decimal point having been moved two places to the left. Abreast of it in the latitude column is found 286.6. Moving this decimal point two places to the right makes the distance off 28660 feet. This divided by 6080, which is the number of feet in a nautical mile, gives the distance off 4.71 miles. The chief advantage of this method is that the distance off may be obtained at any time on any bearing. However, its use is restricted almost entirely to the day time; but may sometimes be used during moonlight nights.

Instead of table 2, table 33 in the latest edition of Bowditch may be used within certain limits.

There are many other methods more or less complicated, and various contrivances for getting the distance off; but those treated here are simple and practical and in some cases it is not necessary to leave the deck or put down a figure to obtain the distance off. It will be noticed that no excuse is left for one skinning around dangerous reefs, points of shoals, outlying rocks, etc., without an accurate knowledge of his distance off, or at least that the ship is outside the danger.

TABLE FOR FINDING THE DISTANCE OFF A VESSEL WILL PASS ANY LIGHT.

Distance visible in nautical miles.	POINTS ON THE BOW												
	½	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7
1	0.1	0 2	0.3	0.4	0.5	0 6	0.6	0 7	0.8	0.8	0.9	0 9	1.0	1.0
2	0.2	0.4	0.6	0.8	0.9	1.1	1.3	1.4	1 5	1.7	1.8	1.8	1 9	2.0
3	0 3	0.6	0.9	1.1	1.4	1.7	1.9	2.1	2 3	2.5	2.6	2.8	2.9	2.9
4	0.4	0 8	1 2	1.5	1.9	2 2	2.5	2.8	3.1	3.3	3.5	3.7	3.8	3.9
5	0.5	1 0	1.5	1.9	2 4	2.8	3.2	3 5	3.9	4.2	4.4	4.6	4.8	4 9
6	0 6	1 2	1 7	2.3	2 8	3.8	3.8	4.2	4.6	5.0	5.3	5 5	5.7	5.9
7	0 7	1.4	2.0	2.7	3.3	3.9	4 4	4.9	5.4	5 8	6.2	6.5	6.7	6 9
8	0.8	1 6	2 3	3.1	3.8	4.4	5.1	5 7	6 2	6 7	7.1	7.4	7.7	7.8
9	0 9	1.8	2 6	3 4	4.2	5.0	5.7	6.4	7.0	7.5	7.9	8.3	8 6	8.8
10	1.0	2.0	2 9	3.8	4 7	5.6	6.3	7.1	7.7	8 3	8.8	9.2	9.6	9.8
11	1.1	2.1	3.2	4 2	5.2	6.1	7.0	7.8	8.5	9.1	9 7	10.2	10.5	10.8
12	1 2	2 3	3.5	4 6	5 7	6.7	7.6	8.5	9 3	10.0	10 6	11.1	11.5	11.8
13	1.3	2.5	3.8	5.0	6.1	7 2	8.2	9.2	10.0	10.8	11.5	12.0	12 4	12.8
14	1.4	2 7	4 1	5.4	6.6	7.8	8.9	9.9	10.8	11 6	12.3	12.9	13.4	13.7
15	1 5	2 9	4.4	5.7	7.1	8.3	9.5	10 6	11 6	12.5	13.2	13.9	14.4	14.7
16	1.6	3.1	4 6	6.1	7.5	8.9	10 2	11 3	12.4	13.3	14.1	14.8	15 3	15.7
17	1.7	3.3	4.9	6 5	8.0	9.4	10 8	12 0	13.1	14.1	15.0	15.7	16.3	16.7
18	1.8	3 5	5.2	6 9	8.5	10.0	11.4	12.7	13.9	15.0	15.9	16.6	17.2	17.7
19	1.9	3 7	5.5	7.3	9.0	10.6	12.1	13.4	14 7	15.8	16.8	17.6	18.2	18 6
20	2.0	3.9	5 8	7 7	9.4	11.1	12 7	14.1	15 5	16.6	17 6	18.5	19.1	19 6
21	2.1	4.1	6 1	8.0	9.9	11.7	13.3	14·8	16.2	17.5	18.5	19.4	20.1	20.6
22	2 2	4.3	6 4	8.4	10.4	12 2	14.0	15.6	17.0	18.3	19.4	20.3	21 1	21.6
23	2 3	4.5	6.7	8 8	10.8	12.8	14.6	16.3	17.8	19.1	20.3	21.2	22.0	22.6
24	2.4	4.7	7.0	9.2	11.3	13.3	15.2	17.0	18.6	20.0	21.2	22.2	23.0	23.5
25	2.5	4.9	7.3	9 6	11.8	13.9	15.9	17 7	19 3	20 8	22.0	23.1	23 9	24.5
26	2.5	5.1	7.5	9.9	12.3	14 4	16 5	18.4	20.1	21.6	22 9	24.0	24.9	25.5
27	2.6	5.3	7.8	10.3	12 7	15.0	17.1	19.1	20.9	22.4	23.8	24.9	25.8	26.5
28	2.7	5.5	8.1	10 7	13.2	15.6	17.8	19.8	21.6	23.3	24.7	25.9	26 8	27.5
29	2.8	5.7	8.4	11.1	13 7	16.1	18.4	20.5	22.4	24.1	25 6	26.8	27.8	28.4
30	2.9	5.9	8 7	11 5	14.1	16.7	19.0	21.2	23.2	24 9	26.5	27.7	28.7	29 4
31	3.0	6.0	9.0	11.9	14 6	17.2	19.7	21.9	24.0	25.8	27.3	28.6	29.7	30.4

Example: A light is visible 17 miles, and is made 3 points on the bow. How far off will she pass the light, if course is not changed? Under 3 points and opposite 17 miles is the distance—9.4 miles.

Height of eye in feet.	Distance visible.	Height of eye in feet.	Distance visible.
5	2′.55	70	9′.56
10	3 .61	75	9 .90
15	4 .43	80	10 .22
20	5 .11	85	10 .54
25	5 .71	90	10 .84
30	6 .26	95	11 .14
35	6 .76	100	11 .43
40	7 .23	110	11 .99
45	7 .67	120	12 .52
50	8 .08	130	13 .03
55	8 .48	140	13 .52
60	8 .85	150	14 .00
65	9 .21	160	14 .46

Table of elevations of objects, with their distances of visibility.

Example: Sandy Hook light, height 90 feet, just visible. Height of eye 20 feet.

Tabular number for 90 feet 10′.84
" " " 20 " + 5 .11
Distance off the light = 15 .95

Nyack, N. Y.,

Mr. H. Louderbough.

Dear Sir.—We take pleasure in giving you a testimonial on the good qualities of your Yacht Copper Paint for yacht bottoms. We have used this Paint on our work for two (2) seasons, and are pleased to say that we find it very satisfactory. It is easy to apply, and makes a smooth and bright finish. We also find it a good Anti-Fouling composition, and will soon have to place another order with you for our regular quantity. Yours very truly,

CHARLES L. SEABURY & CO.

Hoboken, N. J.,

Mr. H. Louderbough.

Dear Sir.—It is from long continued use of a marine paint that its merits become known, and we can testify that your New Jersey Marine Paints have all the merits claimed for them. For eleven years we have been ship-mates with them, and they have satisfied both our customers and ourselves.

Yours truly,

THE TIETJEN & LANG DRY DOCK CO.

Pensacola, Fla.,

Mr. H. Louderbough.

Dear Sir.—At our Railway and with our fleet of Fishing Vessels for several years we have used your "New Jersey" Copper Paint, and we take pleasure in giving our best endorsement for being a Paint of much merit, proving to us that your advertisement, of the fact it "Leads them all," has been established in our minds as being correct.

Very truly yours, E. E. SAUNDERS & CO.

Chance, Maryland,

Mr. H. Louderbough.

Dear Sir.—In the use and sale of your "New Jersey" Copper Paint and your Yacht Red Copper Paint, I have found it a very good protection to vessels engaged in the oyster trade; it is a very great test for a paint to withstand the barnacles and grass growth so very prevalent in the waters of our Chesapeake Bay, and even under these trying conditions your Paint has made for itself many friends.

JAMES L. BENNETT.

Fog Signals.

That sound waves do not travel as far or as fast during foggy weather as they do when fine and clear, is due to the greater density of the atmosphere during thick weather, and is a fact that no seaman is in ignorance of.

Supposing the weather to be thick, but dead calm, there are reasonable distances at which the sound of certain fog signal apparatus would be expected to reach the ear; but no sound is heard. However, another vessel may be a half-mile or even a mile farther off and those on board hear the sound distinctly, a circumstance that is not at all uncommon. In running for a point that is directly ahead, the sound of the fog signal will be heard and then lost, and afterwards again heard and so, and during the time the signal will be in proper operation. And in running so as to pass the signal station a certain distance off, the sound is often heard when the station is three or four points on the bow and not heard when the station is abeam the point to which the passing ship approaches nearest to it; but heard again some time after passing the station.

Every seaman knows that the direction from which the sound of a fog signal comes cannot be located with any degree of certainty unless the sound producing device is quite close. In fact, there are times when the sound apparently comes from points of the compass directly opposite to each other. It seems reasonable, in this case, to suppose one of these sounds to be an echo of the original, but then there comes the difficulty of determining the original. Then again, instead of one of the sounds being an echo, they may be the fog signals of two different ships.

While navigators are quite familiar with the above phenomena, no theory has ever been advanced and accepted as a proper explanation.

A great number of descriptions and diagrams of sound waves have been examined, and as none can be found to satisfy the above conditions for explanatory purposes, it indicates that this very important branch of the subject has escaped the notice of those eminent scientists who investigate matters of this nature, which well deserves their attention. The only theory that seems to account for these so-called mysteries of sound, is that the sound waves increase in size as the distance from the source becomes greater until they become huge waves and pass over a ship that happens to be in that unfortunate position and descend so that those on board the ship at the greater distance would hear the sound.

It then appears that a ship running for a fog signal station that is directly ahead must pick up and lose the sound, as the signal cannot be heard when the sound waves are passing over the ship.

The same theory may be applied to the case of a ship having the fog signal station on her bow and passing it not at a great distance.

It has been noticed that as soon as a fog signal is heard sufficiently distinct to determine the interval of the blast and silence, and to locate the direction from which the sound comes, the source of the sound is not far off.

The only way to distinguish an echo from a fog signal is not to sound the signal with a uniform blast. Blow a very long or short blast occasionally. If a long blast is given and a short one is heard, or a short one is given and a long one heard, it is quite evident that the sound is not an echo. However, as a matter of safety and precaution, these sounds should not be considered as echoes at any time, as there are too many opportunities for fatal error. An echo will be heard all the time the same, while a fog signal will seem nearer or farther away at each blast.

It then follows that no dependence can be placed in fog signals so far as hearing their sounds any great distance, and when heard, it is not known whether they are near or not and the direction from which the sound comes cannot be determined by the ear. It is hoped that an instrument may be supplied for this purpose.

"WETTERSTEDT" COPPER PAINT.

This old brand of Copper Paint was for many years manufactured by Robert F. Seaman, and was the first copper paint made in this country, having been patented here on August 5, 1851. The trade that has always used it says that our manufacture of it has increased its virtues, it being smoother, and in its finer powdered condition the poison is more quickly taken up by the thinner, making it a better anti-fouling paint than ever before. The strong testimonials received have helped greatly its ever-increasing demand.

"WETTERSTEDT'S"

COPPER PAINT

THE FIRST COPPER PAINT MANUFACTURED IN THIS COUNTRY

PATENTED IN ENGLAND, 1846. FRANCE, 1847.
UNITED STATES, AUGUST 5, 1851

FINELY GROUND

WETTERSTEDT'S
FINELY GROUND
EASY TO APPLY
COPPER PAINT
DIRECTIONS FOR USE
FOR PRESERVING VESSELS' BOTTOMS FROM WORMS, BARNACLES SEA GRASS, AND WEEDS.
PATENTED ENGLAND, 1846. FRANCE, 1847. UNITED STATES, AUG. 5, 1851
MANUFACTURED BY
NEW JERSEY PAINT WORKS
JERSEY CITY N.J. U.S.A.

EASY TO APPLY

This Paint was formerly manufactured by R. F. Seaman with other brands of Marine Paints, and having purchased his business, trade-marks, etc., it is now manufactured by

NEW JERSEY PAINT WORKS

HARRY LOUDERBOUGH, Inc.

JERSEY CITY, N. J., U. S. A.

Restoring the Drowned

Prone Pressure Method Best For All Sorts of Suffocation. Including Gas, Smoke, Electric Shock, Fumes, and Water.

By Commodore W. E. LONGFELLOW, Life Saving Corps, American Red Cross.

Many thousands of persons are suffocated each year in the United States. Whether the cause be the inhalation of gases, smoke, fumes of acid, or from an engine, or whether breathing be interrupted by electrical shock or by drowning the treatment to restore is the same in every case. No mechanical device is necessary or even desirable according to some of the greatest authorities in America on this subject. The entire First Aid treatment for suffocation can be applied by hand, on the spot, and without a moment's delay, other than to get the patient in a quite spot where the air is clear.

Restoring the Drowned. Releasing pressure suddenly causes air to be sucked into the lungs from the open mouth. Because of the position of the arms more air is produced than in nose breathing.

There are many erroneous theories about drowning and a study of the bodies of persons suffocated by drowning indicates that there is no more water in the lungs of a drowned person than in the lungs of a person suffocated from other causes. Consequently rolling on a barrel to empty the lungs of water is unnecessary. The first inhalation of water which a drowning person takes, usually sends some drops down the wrong way, setting up spasms of certain throat muscles. The throat is closed, no used air or gas can get out nor can any fresh air filled with oxygen get into the lungs. With only this used gas to work on the heart action is slower and slower and finally becomes ineffective.

In suffocation, however, the saliva or spit in the mouth and throat is released by the glands which secrete it so it is necessary to lay the patient face downward as soon as removed from the conditions that cause smothering. This enables the fluids in the mouth and throat to find their

way out by gravity even though the teeth are shut. A person can breathe through set teeth. Fluids in the mouth will find their way out through set teeth also if the lips are relaxed so it is not necessary to spend time in prying the jaws open before starting artificial breathing. The body will drain if sprawled face downward and the tongue will drop forward out of the throat in this position.

So after laying the suffocated person face downward the chest walls are set for a deep breath by pulling the arms higher than the shoulder level. To protect the nose and mouth being clogged by sand or dirt the left hand is placed under them. The action developed is like that of a vacuum cleaner so the back of the hand beneath the nose and mouth prevents the suction of air pulling dust or dirt into the lungs.

Restoring the Apparently Drowned. Laying the patient face downward and pressing on the back expells the gas from the lungs. There is no water in the lungs.

The First Aider whom we will call the operator in this description, once he has laid his man out in the prone or face downward position drops on both knees on the ground astride the knees of the patient. He turns his hands sideways at right angles to his forearms and coasts them down the ribs of his patient until the little finger drops into the slot or soft space beneath the lowest floating rib. It is this space that the belt is usually worn. The hands rest in the same relation to the spine as a belt and the butts of the hands are about six inches apart. The thumb and all the fingers are folded close together so that the hand becomes in effect, a pressure pad to force out the air.

With the hands in position and it takes much less time to do this than describe it, the operator leans the weight of his upper body forward upon the hands. This weight presses the bowels forward against the big muscle which separates the chest from the abdominal organs. This big muscle or diaphragm is forced up into the chest cavity, reducing the space which the lungs occupy and actually wringing them out. The air or gas is squeezed out of them by the pressing of the other organs against them. A certain amount of heart stimulation is also produced by the rubbing of the other organs against it. This pressure constitutes a complete breath or exhalation.

At the completion of this pressure which lasts as the operator repeats the words "Out—Gas," the operator snaps his hands off the sides and springs himself erect as he says "In—comes—the—air," resting during this time. At the word **"air"** however, he is already to replace his hands and repeat "Out—Gas" with the pressure. These two movements which take five seconds should be repeated regularly for an hour at a time if necessary as they constitute an effective imitation of breathing which produces more air than the real thing. A person can breath for another person for an hour without becoming excessively tired.

A great deal of practice is necessary to produce an accurate imitation of breathing but a person should be able to produce even breathing for a minute or two if timed by a watch before being pronounced efficient at this sort of thing. Persons who have been under water as long as thirty minutes have been resuscitated after a couple of hours steady work. First Aiders should be trained to change places without losing the rhythm or missing a breath. It is important to release the pressure suddenly. Much of the efficiency is lost if the operator bends his arms. They should be straight from shoulder to wrist. Their functions are as connecting rods between the hand and shoulder. A bent connecting rod wastes power.

AFTER TREATMENT

Where gases have been taken into the lungs, or where even a few drops of water have been inhaled, pneumonia is to be feared and the services of a physician may be necessary in this event or in event of heart collapse. It is therefore advisable to get a physician if possible, even though breathing has been restored. If no doctor can be secured it is of course up to the first aider. Patient must be kept warm and must be kept from moving around too soon after being restored to consciousness.

In fact, it is not uncommon for the feeble breathing to stop after it has been started by the prone pressure, and the operator has to start in all over again. Wet garments or tight clothing should be removed, and this can be done while prone pressure is being applied. The patient should be kept as comfortable as possible and when he can swallow stimulants may be given in spoonfuls. Pouring liquids down the throat of a patient before he can swallow is always dangerous. Aromatic spirits of ammonia or even household ammonia or strong smelling salts under the nostrils can be used to excite breathing, even before the patient is able to take liquids.

If the open bottle is held under the nostrils of the patient at the moment of snapping off the hands, every five or six breaths, it is beneficial in arousing the patient in some cases. Sometimes shock by slapping the bottoms of the feet or by dilating the rectal muscle with the thumbs is effective in exciting breathing. Keeping warm, putting to bed, keeping quiet, and when breathing is surely resumed by the giving of warm drinks in small quantities are all useful in the after treatment of suffocated—drowned people.

Start to work without delay as soon as the patient is taken out of the conditions causing suffocation. Work evenly imitating even breathing and checking up with your own breathing, exhaling on the pressure and inhaling during the time of resting. Work for at least an hour of more unless the patient breathes before that time. It has been necessary to work six hours. Don't give up too soon. Moving the patient sometimes spoils his chance for recovery. But bear this in mind, resuscitation is not a cure all and is indicated only for loss of consciousness through suffocation.

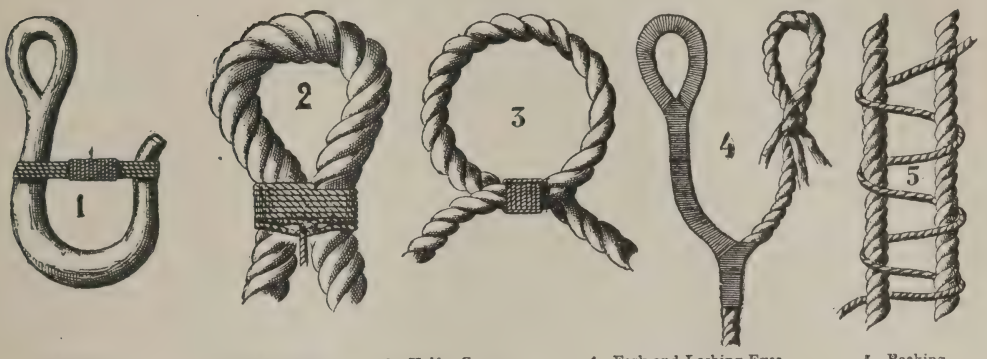
THE BEST AND MOST USED,

"New Jersey" Copper Paint

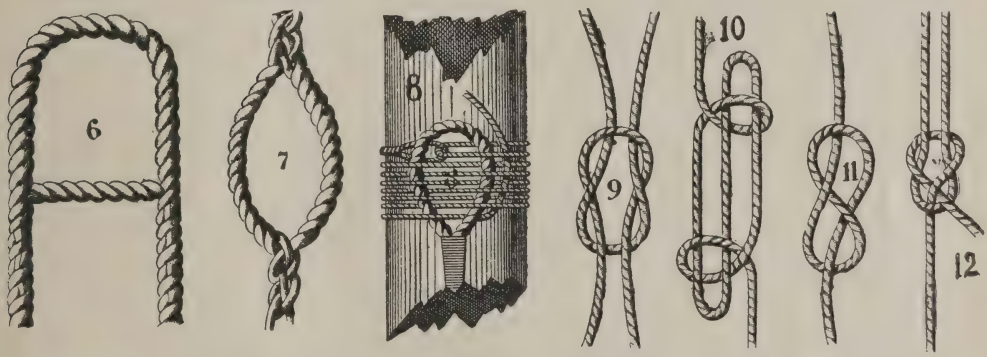
SO SAY OUR TESTIMONIALS.

Seizings, Hitches, Bents, Splices, Etc.

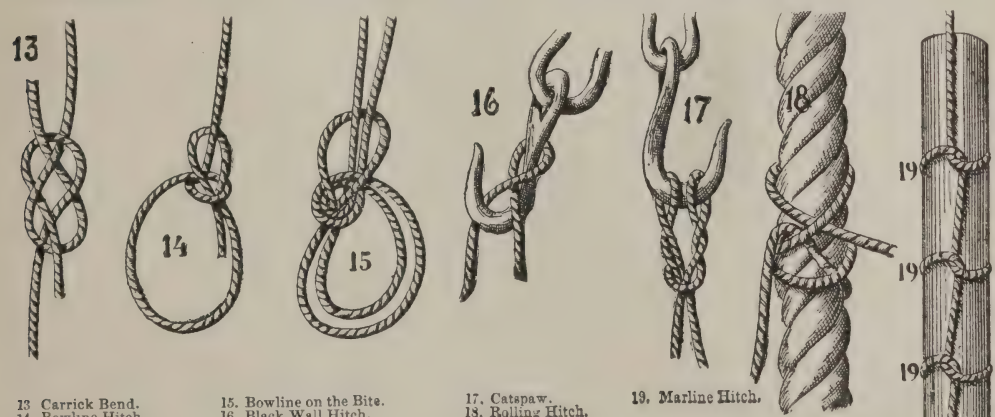
IN EVERY DAY USE.



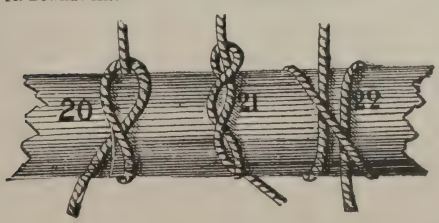
1. Mousing. 2. Throat Seizing. 3. Half a Crown. 4. Fork and Lashing Eyes. 5. Racking.



6. Horse Shoe Splice. 7. Cut Splice. 8. Rose Lashing. 9. Reef Knot. 10. Sheep Shank. 11. Figure of Eight Knot. 12. Single Bend.



13 Carrick Bend.
14. Bowline Hitch.
15. Bowline on the Bite.
16. Black Wall Hitch.
17. Catapaw.
18. Rolling Hitch.
19. Marline Hitch.



20. Half Hitch.
21. Timber Hitch.
22. Clove Hitch.

From M. J. KILEY, Boston.

TWO-CENTURY CALENDAR

YEARS 1801 TO 1902								YEARS 1903 TO 2003							
1801	1802	1803	....	1804	1805	1806		1903	....	1904	1905	1906	1907	....
1807	....	1808	1809	1810	1811	....		1908	1909	1910	1911	....	1912	1913
1812	1813	1814	1815	....	1816	1817		1914	1915	....	1916	1917	1918	1919
1818	1819	....	1820	1821	1822	1823		....	1920	1921	1922	1923	....	1924
....	1824	1825	1826	1827	....	1828		1925	1926	1927	...	1928	1929	1930
1829	1830	1831	....	1832	1833	1834		1931	....	1932	1933	1934	1935	....
1835	....	1836	1837	1838	1839	....		1936	1937	1938	1939	....	1940	1941
1840	1841	1842	1843	....	1844	1845		1942	1943	....	1944	1945	1946	1947
1846	1847	....	1848	1849	1850	1851		....	1948	1949	1950	1951	....	1952
....	1852	1853	1854	1855	....	1856		1953	1954	1955	....	1956	1957	1958
1857	1858	1859	....	1860	1861	1862		1959	....	1960	1961	1962	1963	....
1863	....	1864	1865	1866	1867	....		1964	1965	1966	1967	....	1968	1969
1868	1869	1870	1871	....	1872	1873		1970	1971	....	1972	1973	1974	1975
1874	1875	....	1876	1877	1878	1879		....	1976	1977	1978	1979	....	1980
....	1880	1881	1882	1883	....	1884		1981	1982	1983	....	1984	1985	1986
1885	1886	1887	....	1888	1889	1890		1987	....	1988	1989	1990	1991	....
1891	....	1892	1893	1894	1895	....		1992	1993	1994	1995	....	1996	1997
1896	1897	1898	1899	1900	1901	1902		1998	1999	....	2000	2001	2002	2003
E	F	G	A	B	C	D	January	E	F	G	A	B	C	D
D	E	F	G	A	B	C	January	D	E	F	G	A	B	C
P	Q	R	S	T	U	V	February	P	Q	R	S	T	U	V
✢	W	X	Y	Z	⋈	▬	February	✢	W	X	Y	Z	⋈	▬
A	B	C	D	E	F	G	March	A	B	C	D	E	F	G
L	M	N	O	H	J	K	April	L	M	N	O	H	J	K
F	G	A	B	C	D	E	May	F	G	A	B	C	D	E
J	K	L	M	N	O	H	June	J	K	L	M	N	O	H
D	E	F	G	A	B	C	July	D	E	F	G	A	B	C
G	A	B	C	D	E	F	August	G	A	B	C	D	E	F
K	L	M	N	O	H	J	September	K	L	M	N	O	H	J
E	F	G	A	B	C	D	October	E	F	G	A	B	C	D
H	J	K	L	M	N	O	November	H	J	K	L	M	N	O
C	D	E	F	G	A	B	December	C	D	E	F	G	A	B

DIRECTIONS.

Look for the Year desired, and follow the column in which it is found down to the square on a line with the Month wanted. The letter or sign within this space is the symbol of the Calendar on the opposite page, which will give the days of the week for the month and year in question.

Years printed in red are "Leap Years." For the months of JANUARY and FEBRUARY in Leap Years be guided by the red letters and signs given for those months.

WINTER'S TWO-CENTURY CALENDAR. COPYRIGHT, 1900, BY JOHN F. WINTER.

TWO-CENTURY CALENDAR

A

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
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B

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C

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J

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N

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O

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P

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Q

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21	22	23	24	25	26	27
28	..	..	..	..	..	..
..	..	..	..	..	..	..

R

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..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	..	..	..	..	..
..	..	..	..	..	..	..

S

S	M	T	W	T	F	S
..	..	..	1	2	3	4
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Ship Stores and Vessel's Supplies.

Ice
Fresh Beef
" Pork
" Lamb
" Mutton
Bbls. Beef
" Pork
Lbs. Pork
Bbls. Flour
" Potatoes
" Turnips
" Parsnips
" Onions
Doz. Cabbage
Hams
Shoulders
Bacon
Lbs. Codfish
¼ Bbl. Mackerel
Kitt Mackerel
Kitt Tongues and Sounds
Kitt Halibut Fins
Gall. Molasses
Gall. Syrup
Bot. Maple Syrup
Gall. Vinegar
Lbs. Lard
" Cabin Butter
" Crew Butter
" Granulated Sugar
" "C" Sugar
" Cabin Coffee
" Crew Coffee
" Mx. Tea
" Green Tea
" Black Tea
" Japan Tea
Pk. White Beans
" Red Beans
" Lima Beans
" Yellow Eye Beans
" Dried Peas
" Split Peas
Lbs. Evap. Apples
" " Peaches
" " Apricots
" Prunes
" " Best
" Raisins
" Currants
Boxes Cocoa
Pa. Cocoanut
Boxes Ex. Lemon
" " Vanilla
" " Ginger
Lbs. Ginger
Pa. Thyme
" Sage
Corn Starch
Nutmegs
Boxes Mustard
Bottle Mustard
Bags Salt
Lbs. Pepper
" Rice
Lbs. White Corn Meal
" Yellow Corn Meal
" Barley
Pa. Hominy
" Samp
" Oat Flakes
" Cream of Wheat
" Tapioca
" Sago
" Prepared Buckwheat
Lbs. Buckwheat
" Pilot Bread
Pa. Yeast Cakes
Bottles Rumford's
Lbs. Baking Powder
" Baking Soda
" Hops
Pa. Cinnamon
" Allspice
" Cloves
Bot. Curry Powder
" Catsup
" Sweet Oil
" Gherkins
" Mx. Pickles
" Chow Chow
Pails Gherkins
" Chow Chow
" Mx. Pickles
" Mince Meat
Pa. Mince Meat
" Gold Dust
" Pearline
" Soapine
Lbs. Sal. Soda
Bars Soap
Cakes Soap
" Sapolio
Bot. Ammonia
Bath Brick
Gross Matches
Boxes Parlor Matches
Pa. Stove Polish
Macaroni
Eggs
Coffee Essence
Cans Milk
" Tomatoes
" Corn
" Peas
" Lima Beans
" Succotash
" String Beans
" Peaches
" Pears
" Apricots
" Apples
" Pumpkin
" Pineapple
" Cherries
" Blackberries
" Blueberries
" Smoked Beef
" Corned Beef
" Roast Mutton
Cans Roast Beef
" Tongue
" Chicken
" Turkey
" Lobster
" Salmon
" Soft Clams
" Quahogs
" Lye

VESSEL'S LIST.

Galls. Kerosene Oil
" Boiled Oil
" Raw Oil
" Turpentine
" Dryer
" Bright Varnish
" Spar Varnish
" Tar
Packing
Piston Packing
Zinc
Spikes
Nails
Red Lead
Waste
Tallow
Gasolene
Cylinder Oil
Engine Oil
Sperm Oil
Lard Oil
Lbs. White Lead
Paint Brushes
Brooms
Balls Cotton Twine
Sk. Hemp Twine
Sail Needles
Coils Marline
" Spun Yarn
" Hambroline
" Roundline
" Hay Rope
Faths. Ratline
" Tarred Rope
" Tarred Rope
" Manila
" Manila
" Manila
Chimneys
Wicks

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Yacht Green Copper Paint
Yacht White
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Anti-Fouling Composition
Perfect Ship Black
Ship Zinc
Ship Lead
Mastine
Marine Mixed Paints
Liquid Metal Polish

Ship Stores and Vessel's Supplies

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No Alkali
No Water
No Benzine

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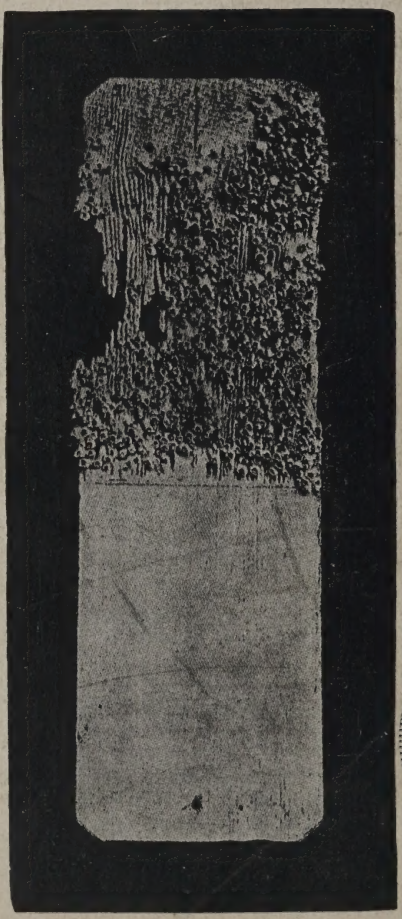

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